Print ISSN: 2319-2003 | Online ISSN: 2279-0780

IJBCP International Journal of Basic & Clinical Pharmacology

DOI: http://dx.doi.org/10.18203/2319-2003.ijbcp20193609

Original Research Article

Patients' sensory perception and satisfaction with use of metered dose inhalers and dry powder inhalers in moderate persistent asthma

Mahesh C. Gupta[1], Jyoti Khanna[1]*, Dhruva Chaudhry[2]

[1]Department of Pharmacology, [2]Department of Pulmonary and Critical Care Medicine, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak, Hariyana, India

Received: 01 July 2019
Accepted: 29 July 2019

***Correspondence to:**
Dr. Jyoti Khanna,
Email: jk.jyotikhanna1@gmail.com

ABSTRACT

Background: Inhalers containing corticosteroid and a long acting β2 agonist (LABA) are widely used in asthma treatment. This study assessed the patient sensory perception and satisfaction of budesonide/formoterol fixed dose combination by pressurized metered dose inhalers (pMDI) with spacer and dry powder inhalers (DPI) in patients of moderate persistent asthma.
Methods: This was a 6 week prospective, randomized, open label, comparative, parallel group clinical study. All patients had a forced expiratory volume in 1 second (FEV1) of 60-80% predicted normal. The patients were assessed for sensory perception and satisfaction in group I (pMDIs with spacers) and group II (DPIs) using patient evaluation questionnaire (PEQ) and patient satisfaction and preference questionnaire (PASAPQ) at the end of 6th week.
Results: In PEQ, statistical analysis of the mean attribute ratings showed that both the devices were easy to use by patients. More medication was felt reaching throat using DPIs. Patients on DPI liked the taste and felt it to be less strong than patients on pMDIs. The overall liking was statistically comparable in two groups. In PASAPQ, the patients on DPI group were very satisfied with the treatment than pMDI ($p<0.05$).
Conclusions: Overall liking of both DPIs and pMDIs was comparable and patients on DPI were satisfied more with the treatment device. Patient sensory perception and satisfaction may be taken into account in selecting device to improve compliance to treatment.

Keywords: Asthma, Dry powder inhalers, Metered dose inhalers, Patient satisfaction, Sensory perception

INTRODUCTION

Bronchial asthma is a serious global health problem. Around 339 million people suffer from asthma worldwide.[1] Low and middle-income countries suffer from the most severe cases. In India, 15-20 million people suffer with this disease.[2] Asthma is chronic inflammation of the mucosa of lower airways and thus cause airflow limitation resulting in episodic wheezing, difficulty in breathing, nocturnal waking, chest tightness and cough.

Inhalational therapy is the mainstay treatment of patients with moderate persistent asthma. Inhaled medications are available as pressurized metered dose inhalers (pMDIs), breath-actuated MDIs, dry powder inhalers (DPIs), soft mist inhalers and nebulised or wet aerosols. Individual patient preferences and convenience of use may influence the efficiency of drug delivery and patient adherence to treatment and long term control.

pMDIs deliver a specific amount of medication i.e. metered dose with each actuation. Drugs are propelled

from a canister with the aid of a propellant which is a hydroflouroalkane (HFA).[3] The pMDIs generate aerosol faster than the patient can inhale. Thus, coordination between device actuation and patient inhalation is necessary.[4] A spacer is used as an add-on device to pMDIs as it acts as a holding chamber and reduces the speed at which the aerosol enters the mouth.[5]

Dry powder inhalers are devices that deliver a drug in a fine micronized powder form. It does not contain propellant.[6] These devices may be preferred by some patients because careful coordination is not necessary as with the pMDIs.[7] DPIs rely on the force of patient inhalation to break up the powder into particles that are small enough to reach the lungs. It is for this reason that DPIs are normally used only in older children and adults.[8]

Drugs delivered using various devices is effective in most of the cases, but its true success relies on how well utilized the device is by the patient. The use with the device and patient preference and satisfaction depends on literacy rates, age and disease severity of the patient. Ease of use with the device determines adherence of the patient to the treatment.[9-14]

Bunnag et al, conducted a multicentre comparative study of patient's preferences and sensory perceptions of three forms of inhalers- pMDIs (Chlorofluorocarbon (CFC) and non-CFC HFA) and DPI using salbutamol and found that the most preferred form to be prescribed was DPIs followed by non-CFC and CFC pMDIs. Regarding ease of use 59.1% of patients showed no difference. DPIs were more irritating as compared to pMDIs.[15]

An observational study by Ramadan et al found that higher percentage of DPI users found their device easy to use as compared to pMDIs.[16] Aggarwal et al, conducted a comparative study using pMDIs and DPIs and observed that patients were more satisfied with the use of metered dose inhalers and hence showed better adherence than patients on DPIs.[17]

India, particularly Haryana, has poor literacy rate so educating the patients for the proper use of such devices is a real challenge.

The familiarity of the physician with inhalers and their skills in understanding patient's needs also determines treatment outcomes.

Device efficiency and preference may be highly influenced by the form of devices, formulation of the medication, particle size, the velocity of aerosol-cloud and ease with which the device can be used by the patient, taste and adverse effects apart from socio-cultural factors such as beliefs, knowledge and education.[18]

There were no studies in India which addressed the issue of sensory perception and how it can affect the overall liking and satisfaction of the patient.

This study aims to evaluate patient sensory perception and satisfaction with fixed dose combination of budesonide and formoterol using pMDIs and DPIs in moderate persistent asthma patients.

METHODS

This was a prospective, randomized, open label, comparative, parallel group clinical study conducted by the Departments of Pharmacology and Pulmonary and Critical Care Medicine, Pt. B.D. Sharma PGIMS, Rohtak (Haryana). The study was in accordance with the principles of Good Clinical Practice (GCP) and Declaration of Helsinki with its subsequent amendments. A written informed consent was obtained from all the patients enrolled for the study. The study was approved by PG Board of study, Pharmacology and Dean Faculty in Para-clinical sciences, University of Health Sciences, Rohtak.

Study sample

Patients were screened with the help of a predefined inclusion and exclusion criteria for the study. The inclusion criteria were adult outpatients of both genders between 18-45 years of age with stable moderately persistent asthma as confirmed by the clinician as per the ATS guidelines (daily symptoms, night time awakening more than 1/week, FEV1 60-80% of predicted value, reversibility of ≥12% and ≥200ml in FEV1 or FVC 15 minutes after inhaling salbutamol 200-400 µg) and willingness to provide informed consent. The exclusion criteria were patients suffering from lung diseases other than asthma, acute medical illness (other than asthma) within last 6 weeks prior to start of study, any other chronic co-morbidity except chronic rhinitis, extreme obesity, history of allergy or adverse drug reaction to study drugs and those who refused informed consent. Total of 50 patients, 25 patients in each group completed the study and were subjected to as per protocol analysis.

Study treatment

The patients were randomly allocated to the two treatment groups using different devices for inhalational therapy with the help of computer generated random numbers. Group I patients received budesonide (200µg)/formoterol 6µg fixed dose combination 2 puffs twice a day via a pMDIs with spacer (145ml) while group II received same drug combination in same dose and frequency via DPIs (rotahalers).

Additional 4 puffs of same drugs via respective inhalers were allowed as rescue medication in case of continued asthma symptoms or any exacerbations. The patients who were still not controlled were withdrawn from the study and were provided with adequate and appropriate treatment by the treating clinician.

Commercially available brands of the combination and inhalers were used in the study and same brand was utilised throughout the study. The patients were trained adequately for the correct use of inhaler before the start of treatment.

Clinical assessment

The study was conducted over a period from September 2013 to October 2014 and was of 6 week duration after the treatment interventions. The patients enrolled were adequately trained for the use of devices. Baseline characteristics i.e. demographic and clinical characteristics were recorded in all the eligible patients like age, gender, history of duration of asthma, history of drug intake for asthma in past and history of drug allergies. All the eligible patients were given one week run in period during which they underwent routine laboratory investigations and pulmonary function tests as per ATS criteria. During this period, they were allowed inhaled corticosteroids (ICS) and short acting β2 agonists (SABAs) only. SABAs were stopped 24 hours before the study drug intervention. The patients who were already on ICS and long acting β2 agonists (LABAs) were asked to stop treatment at least 3 days before the run in period. The clinical evaluation of eligible patients was carried out at baseline and then at the end of 2^{nd}, 4^{th} and 6^{th} week.

Outcome measures

Patients evaluation questionnaire

In the 12 item patient evaluation questionnaire , patients rated the test product on a 100 point visual analogue scale (VAS) for the following parameters: ease of use, amount of medication reaching the throat, irritation, urge to cough, detection of odour (yes/ no), strength of odour, liking for odour, detection of taste (yes/ no), strength of taste, liking for taste after inhalation, how dry or moist the mouth feels and overall liking for the product. 15 Participants were asked to read the questionnaire prior to the start of treatment so that they know what and how to evaluate. They were prescribed medication and instructed on the use of device correctly. The patients were given questionnaire to fill 15 minutes after medication was inhaled. Evaluation was done at the end 6 weeks.

Patient satisfaction and preference questionnaire (PASAPQ)

The 16 item patient satisfaction and preference questionnaire (PASAPQ) included 13 satisfaction items in two domains- 7 items in performance domain and 6 items in convenience domain, item 14 assessed overall satisfaction and item 15 and 16 were standalone questions on preference and willingness to continue using the device.19 In part 1, patients rated each of the 13 satisfaction items using a 7-point Likert scale (1=very dissatisfied, 2=dissatisfied, 3=somewhat dissatisfied, 4=neither satisfied nor dissatisfied, 5=somewhat satisfied, 6= satisfied and 7=very satisfied) as well as answered a global satisfaction question. In part 2, there were standalone questions on inhaler preference and willingness to continue the device. This part was omitted from the study because the trial design was such that each patient could use only one inhaler throughout study; they could not compare both inhalers and hence cannot state their preferences. Evaluation was done at the end of 6 weeks.

Statistical analysis

To fulfil the objectives of the study, both descriptive as well as inferential statistics were applied. In the descriptive analysis, mean±standard error of mean (SEM) were calculated. Homogeneity of treatment groups for age, gender, height, weight, duration of illness, treatment history and chief complaints were analyzed by descriptive analysis using chi square test. The patient evaluation questionnaire and level of satisfaction was analyzed using independent sample t test for parametric data and Mann Whitney U test and chi square test for non-parametric data. Statistical analysis was done on patients who completed the study using SPSS statistics. 'p' value less than 0.05 was taken as statistically significant.

RESULTS

A total of 110 patients with clinical suspicion of moderate persistent asthma were screened for the study. Out of these, 48 patients were excluded as they did not match the predefined inclusion criteria - 10 had FEV1 <60% of the predicted value, 6 had FEV1 >80% of the predicted value, 8 patients refused to give informed consent, 1 patient had history of adverse event with the study drug, 7 patients were found to be less than 18 yrs of age and 16 were found to be more than 45 years of age. Out of the 62 eligible patients only 50 patients completed the study and the rest were lost to follow up. The eligible patients were randomly allocated based on computer generated random numbers in two groups- Group I received medicine with conventional MDI and Group II with DPI. The baseline characteristics of the study population were comparable in both groups in terms of age, gender, height, weight and lung function tests (Table 1).

Patient evaluation questionnaire

Statistical analysis of the mean ranks showed that both the devices were easy to use (0 on VAS) by the patients and hence both the groups were comparable. The amount of medication reaching the throat was less felt in patients using MDI as compared to DPI (p=0.000).

Regarding irritation in throat majority in both the groups did not feel irritation. Patients on DPI felt more irritation than patients on MDI although results were statistically nonsignificant. Similarly, patients on DPI felt more urge

to cough than patients on MDI but difference was not statistically significant (Table 2).

In terms of detection of odour, majority of patients in both the groups did not detect the odour. The strength of odour was equivalent in both the groups. Regarding liking of odour 2 out of 4 who detected the odour showed extreme dislike in MDI group. However, the results were statistically insignificant. Regarding detection of taste majority in both the groups were able to detect the taste. Strength of taste was felt to be strong in patients on MDI as compared to patients on DPI and the difference was statistically significant. Patients on DPI liked the taste more than patients on MDI.

Table 1: Comparison of demographic characteristics of study population in both the groups.

Demographic parameters	Group I (n=25)	Group II (n=25)	P value
Age (years)	34.92±1.53	33.20±1.62	0.443*
Female: male	21/4	21/4	1.000*
Height (cms)	159.04±1.52	155.48±1.34	0.403*
Weight (kg)	57.76±2.30	51.64±4.08	0.197*
Lung function tests			
FEV1 predicted value (litres)	2.99±0.08	3.34±0.11	0.07*
Pre-bronchodilator FEV1 value (%)	63.48±1.07	61.48±0.73	0.17*
Post-bronchodilator FEV1 value (%)	73.28±1.19	70.68±0.89	0.14*
FEV1/FVC predicted value	81.91±0.69	88.73±1.58	0.07*
Pre-bronchodilator FEV1/FVC value (%)	82.92±2.05	83.60±1.46	0.79*
Post-bronchodilator FEV1/FVC value (%)	89.36±1.67	93.48±1.33	0.07*
Reversibility in FEV1 (%) after bronchodilator	17.52±1.04	20.64±1.69	0.14*
Reversibility in FEV1 (ml) after bronchodilator	244±1.01	224±1.09	0.08*

All values are expressed as Mean ±SEM. Group I: pMDIs with spacer; Group II: DPIs; * means non-significant (p>0.05)

The patients using pMDI felt dryness in throat after inhalation and those using DPI felt moist in throat and results were statistically significant. In terms of overall liking, patients in both the groups showed liking for the devices and results were comparable. Adverse effects were reported during the study period. 12% patients in pMDI group reported more than one event. In pMDI group, 12% had headache, 8% had cough and 4% reported of nausea, palpitations and anxiety during the study period. In DPI Group, no patient had more than one event. 4% had reported upper respiratory tract infection.

Table 2: Patient evaluation questionnaire.

Patient evaluation	pMDIs	DPIs	P-value
Easy to use (VAS, 0=easy, 100=Difficult)	0	0	1.000
Medicine reaching the bronchi (VAS, 0=none, 100=extreme amount)	60.00±4.71	98.40±1.25	0.000*
Irritation (VAS, 0=none, 100=extreme irritation)	10.00±3.23	12.4±4.72	0.914
Urge to cough (VAS, 0=none, 100=strong urge)	3.00±1.66	7.6±3.39	0.394
Able to detect an odour, yes	4 (16%)	3 (12%)	0.684
Strength of odour (VAS, 0=none, 100=strong odour)	50.00±0.00	50.00±0.00	1.000
Liking for odour (VAS, 0=dislike, 100=like)	25.00± 14.43	50.00±0.00	0.182
Able to detect a taste, yes	20 (80%)	22 (88%)	0.440
Strength of taste (VAS, 0=none, 100=strong taste)	51.50±5.39	45.45±2.104	0.017*
Like the taste (VAS, 0=dislike, 100= like)	42.50±5.49	69.09±3.71	0.001*
Dry/moist (VAS, 0=dry, 100=moist)	46.80±4.28	59.80±3.13	0.018*
Overall liking (VAS, 0=dislike, 100=like)	91.60±2.56	90.00±2.76	0.673

Values expressed as Mean±SEM. Group I: pMDIs with spacer; Group II: DPIs; * means statistically significant (p<0.05).

Patient satisfaction and preference questionnaire (PASAPQ)

It was assessed at the end of 6 weeks using a self-report questionnaire containing 14 items that includes 13 satisfaction items in two domains- performance and convenience. Patients in group I were satisfied with the use of the pMDI and patients in group II were very satisfied with the use of device regarding all questions in performance domain and majority of questions in convenience domain. The total score was significantly higher in patients on DPIs (Table 3).

DISCUSSION

The present study was conducted in a prospective randomized manner to assess differences in the patient's sensory perception and patient's satisfaction level with the use of pMDIs with spacers and dry powder inhalers in moderate persistent asthma in patients of tertiary care centre in North India after adequately training the patients with the use of these devices.

The patient's evaluation questionnaire was included to indicate patient's sensory perception of the inhaler used. The present study is in agreement with the previous study by Bunnag et al, regarding ease of use in that both devices were found to be comparable.[15] Unlike previous study, amount of medication reaching the throat was more felt in patients on DPI. In case of pMDIs, the medicine not being felt at the back of throat may not be clinically relevant as with the correct technique of inhaling one may still inhale the desired amount of medicine into lungs. Both the devices cause some irritation. Irritation with pMDIs could be because of various additives and cold propellants in it.[20] Irritation and urge to cough with DPIs may be attributed to powder form of inhalation and high inspiratory flow rate that is required for successful use of DPI.[21] Perception of odour and taste were equivalent in both the groups in contrast to the previous study. Both devices were equivalent in terms of perception of strength of odour and liking for it. In contrast to the previous study by Bunnag et al, in this study pMDIs were perceived to be stronger in taste and liking of taste with DPIs was more.[15] As opposed to the previous study in which there was no significant difference in dry/moist feeling in the throat, in this study pMDIs cause dryness in throat and DPIs cause moist feeling in throat. Despite some differences regarding the sensory perception in both devices the overall liking was comparable which is in agreement to previous study.

There were adverse effects noted with the use of two devices. The higher rate of adverse events reported in group I could be attributed to propellant as they make up more than 99% of the delivered dose by pMDI.[3] However, the adverse events reported were because of the disease per se or because of the study drug or device cannot be ascertained.

Table 3: Patient satisfaction and preference questionnaire (PASAPQ).

Domains	Question description	pMDIs	DPIs	P value
Performance domain	Overall feeling of inhaling	6.56±0.10	7.00±0.00	0.000*
	Inhaled dose goes to lung	5.96±0.19	7.00±0.00	0.000*
	Amount of medication left	5.08±0.21	7.00±0.00	0.000*
	Works reliably	6.56±0.10	7.00±0.00	0.000*
	Ease of inhaling a dose	6.64±0.10	7.00±0.00	0.001*
	Using the inhaler	6.64±0.10	7.00±0.00	0.001*
	Speed medication comes out	6.68±0.10	7.00±0.00	0.002*
Convenience domain	Instructions for use	6.68±0.10	7.00±0.00	0.002*
	Size of inhaler	6.80±0.08	7.00±0.00	0.020*
	Durability of inhaler	6.80±0.08	7.00±0.00	0.020*
	Ease of cleaning inhaler	6.16±0.15	7.00±0.00	0.000*
	Ease of holding during the use	6.80±0.08	7.00±0.00	0.020*
	Convenience of carrying	6.88±0.07	7.00±0.00	0.077
	Total score	84.32±0.87	91.00±0.00	0.000*
	Overall satisfaction	6.72±0.09	7.00±0.00	0.005*

Values expressed as Mean±SEM. Group I: pMDIs with spacer; Group II: DPIs; *means statistically significant ($p<0.05$).

Miravitles et al, conducted cross sectional study to compare inhalational device handling and patient satisfaction in COPD using PASAPQ score with two devices- respimat soft mist inhalers and breezehaler (DPI) and concluded that patients were equally satisfied with the use of the two devices.[22] Another study by Aggarwal et al on patient satisfaction using MDI and DPI using treatment satisfaction questionnaire for medication (TSQM) found that both devices provide equivalent treatment satisfaction.[17] In contrast to previous studies, in our study PASAPQ questionnaire was used and observed that patients on DPIs were very satisfied with the treatment in terms of all items. Ramadan et al observed that higher percentage of DPI users performed exact technical steps of administration of medicine as compared to MDI users and this could be the reason for

higher satisfaction levels in this study. Also use of DPIs does not require careful coordination as in case pMDIs.[16] Another reason for higher satisfaction in DPI users could be less strong taste and hence more liking for the taste of DPI, more amount of drug that is felt reaching the throat, slight moist feeling in throat after inhalation (no dryness) and few adverse effects with the device.

CONCLUSION

Overall liking of both DPIs and pMDIs was comparable and patients on DPIs were satisfied more with the treatment device. Patient sensory perception and satisfaction may be taken into account in selecting device to improve compliance to treatment.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. The Global Asthma Report. c2018. Available at: www.globalasthmareport.org. Accessed on 30 May 2019.
2. Jindal SK, Aggarwal AN, Gupta D, Agarwal R, Kumar R, Kaur T, et al. Indian study on epidemiology of asthma, respiratory symptoms and chronic bronchitis in adults. Int J Tuberc Lung Dis. 2012;16(9):1270-7.
3. Dolovich M. New Delivery systems and propellants. Can Respir J. 1999;6(3):290-5.
4. Togger D, Brenner P. Metered dose inhalers. Am J Nurs. 2001;101:29-32.
5. Newman SP. Spacer devices for metered dose inhalers. Clin Pharmacokinet. 2004;43(6):349-60.
6. Harris DS, Smith SJ. Dry Powder Inhaler. United States Patent No. US8261739B2. 2012. Available at: https://patents.google.com/patent/US8261739B2/en. Accessed on 15 May 2015.
7. Finlay WH. The mechanics of inhaled pharmaceutical aerosols: an introduction, 1st edn. Boston: Academic Press; 2001:47-91.
8. Voss A, Finlay WH. Deagglomeration of dry powder pharmaceutical aerosols. Int J Pharm. 2002;248(1-2):39-50.
9. Arora P, Kumar L, Vohra V, Sarin R, Jaiswal A, Puri MM et al. Evaluating the technique of using inhalation device in COPD and bronchial asthma patients. Respir Med. 2014;108(7):992-8.
10. Sestini P, Cappiello V, Aliani M, Martucci P, Sena A, Vaghi A. Prescription bias and factors associated with improper use of inhalers. J Aerosol Med. 2006;19(2):127-36.
11. Lee SM, Chang YS, Kim CW, Kim TB, Kim SH, Kwon YE, et al. Skills in handling Turbuhaler, Diskus, and pressurized Metered-Dose Inhaler in Korean asthmatic patients. Allergy Asthma Immunol Res. 2011;3(1):46-52.
12. Rootmensen GN, Van Keimpema ARJ, Jansen HM, De Haan RJ. Predictors of incorrect inhalation technique in patients with asthma or COPD: a study using a validated videotaped scoring method. J Aerosol Med Pulm Drug Deliv. 2010;23(5):323-8.
13. Giraud V, Roche N. Misuse of corticosteroid metered-dose inhaler is associated with decreased asthma stability. Eur Respir J. 2002;19(2):246-51.
14. Wieshammer S, Dreyhaupt J. Dry powder inhalers: which factors determine the frequency of handling errors? Respiration. 2008;75(1):18-25.
15. Bunnag C, Fuangtong R, Pothirat C, Punyaratabandhu P. A comparative study of patients' preferences and sensory perceptions of three forms of inhalers among Thai asthma and COPD patients. Asia Pac Allergy Immunol. 2007;25(2-3):99.
16. Ramadan WH, Sarkis AT. Patterns of use of dry powder inhalers versus pressurized metered-dose inhalers devices in adult patients with chronic obstructive pulmonary disease or asthma: An observational comparative study. Chronic Respiratory Dis. 2017;14(3):309-20.
17. Aggarwal AN, Kumari R, Grover S. Patient satisfaction with inhaled medication for asthma. Respir Care 2018;63(7):859-64.
18. Anderson P. Patient preference for and satisfaction with inhaler devices. Eur Resp Rev. 2005;14(96):109-16.
19. Kozma CM, Slaton TL, Monz BU, Hodder R, Reese PR. Development and validation of a patient satisfaction and preference questionnaire for inhalation devices. Treat Respir Med. 2005;4(1):41-52.
20. Khilnani GC, Banga A. Aerosol Therapy. JIACM. 2004;5:114-23.
21. Ross DL, Schultz RK. Effect of inhalation flow rate on the dosing characteristics of dry powder inhaler (DPI) and metered dose inhaler (MDI) products. J Aerosol Med. 1996;9(2):215-26.
22. Miravitlles M, Montero-Caballero J, Richard F, Santos S, Garcia-Rivero JL, Ortega F et al. A cross-sectional study to assess inhalation device handling and patient satisfaction in COPD. Int J Chron Obstruct Pulmon Dis. 2016;11:407-15.

Cite this article as: Gupta MC, Khanna J, Chaudhry D. Patients' sensory perception and satisfaction with use of metered dose inhalers and dry powder inhalers in moderate persistent asthma. Int J Basic Clin Pharmacol 2019;8:1970-5.