ISSN- O: 2458 - 868X, ISSN –P: 2458 - 8687

International Journal of Medical Science and Innovative Research (IJMSIR)

IJMSIR : A Medical Publication Hub

Available Online at: www.ijmsir.com

Volume – 2, Issue –6, November – December - 2017, Page No. : 308 - 321

A Randomized Controlled Open Label Study to Compare the Efficacy and Tolerability of Budesonide / Formoterol Single Inhaler Therapy versus Fluticasone / Salmeterol as Maintenance and Reliever Therapy in Moderate Asthma.

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Conflicts of Interest: Nil.

Abstract

Objectives:

Achieving and maintaining asthma control is the major goal of asthma care, based on the Global Initiative for Asthma (GINA) 2011 guidelines.(1) International guidelines recommend the combination of a long-acting beta2-agonist (LABA) with low-to-medium dose inhaled corticosteroids (ICS) if asthma is not fully controlled by ICS alone, as first choice treatment in moderate asthma. It is used as maintenance therapy with a short acting beta2-agonist (SABA) as a reliever therapy.(2)(3) The use of one inhaler for both maintenance and as needed reliever medication, simplifies asthma therapy, which is likely to improve patient adherence. The objective of this study was to compare the efficacy of budesonide/formoterol single inhaler therapy as maintenance and reliever therapy versus fluticasone/salmeterol with as needed SABA (levosalbutamol) in patients with moderate asthma.

Methods: A randomized controlled open label comparative, parallel group study with a duration of 6 months. 96 patients diagnosed clinically with moderate asthma, attending outpatient clinic department of chest medicine were recruited based on the inclusion and exclusion criteria. Subjects were randomized into two groups of 48 each. They received either budesonide/formoterol 160/4.5 µg one inhalation twice daily, plus additional inhalations as needed (budesonide/formoterol single inhaler therapy) or fluticasone /salmeterol 50/250 µg one inhalation twice daily, plus levosalbutamol for rescue medication. Assessments were done by evaluating, pulmonary function parameters, asthma control (ACQ5) and Quality of Life (miniAQLQ) at baseline, 4 weeks, and a 6 month telephonic follow up of asthma control (ACQ5) and Quality of Life(miniAQLQ).

Results: On comparing the efficacy of the two groups, patients on budesonide/formoterol group had greater improvements in asthma control (ACQ5 overall score, percent of patients with a clinically significant improvement of 0.5 on the ACQ5) at 4 week visit and 6 month telephonic follow up. The improvement in pulmonary function parameters (FVC,PEF) and small airway involvement (FEF 25-75) were statistically significant with a p value of 0.015,<0.001<0.001,<0.001,0.008 respectively .

Budesonide/formoterol group had greater improvements in symptoms, activity, social , environment sub-domains of mini AQLQ score, which was statistically significant with a p value of<0.001, <0.001,<0.001,<0.001 respectively.

Conclusion: It can be concluded from this study that single-inhaler therapy with budesonide/formoterol for maintenance and relief, having an increased efficacy and ease of administration, does provide an improvement in patients with moderate asthma

Keywords: budesonide/formoterol, single inhaler therapy, moderate asthma.

Introduction

Asthma represents a global public health issue due to high prevalence rates in the general population (1% to 18% of the population in different Countries), currently affects approximately 300 million people worldwide. The prevalence of asthma has risen in affluent countries over the last 30 years, with approximately 10–12% of adults and 15% of children affected by the disease. In developing countries, there is a rising prevalence, which is associated with increased urbanization. Achieving and maintaining asthma control is the major goal of asthma care, based on the Global Initiative for Asthma (GINA) 2011 guidelines.(1) International guidelines recommend the combination of a long-acting beta2-agonist (LABA) with low-to-medium dose inhaled corticosteroids (ICS) if asthma is not fully controlled by ICS alone, as first choice treatment in patients with moderate asthma as maintenance therapy plus a short acting beta2-agonist(SABA) as a reliever therapy.(2)(3) (4).

Most widely used fixed dose ICS/LABA combinations are fluticasone/salmeterol and budesonide/formoterol .These combinations have been used as fixed maintenance-dose regimens; however, budesonide/formoterol single inhaler therapy is also licensed for use as both maintenance and reliever therapy (budesonide/formoterol single inhaler therapy).(4)

Although efficacy and safety of both combinations have been proved individually, head to head comparisons between the two combinations do not arrive at a consensus and comparisons made in previous studies were randomised clinical trials, which may not be representative of real life clinical setting. The use of one inhaler for both maintenance and as needed medication, simplifies asthma therapy and is likely to improve patient adherence .As there are minimal studies in India , it was considered desirable to take up the present study to compare the efficacy and tolerability of budesonide/formoterol single inhaler maintenance and reliever therapy versus fluticasone /salmeterol with as needed SABA (levosalbutamol).

Methods

A randomized controlled open label comparative, parallel group study with follow-ups at 4 weeks and 6 months .The data was collected from the patients visiting department of chest medicine, M.S Ramaiah College Hospitals. 96 patients clinically diagnosed with moderate asthma, attending the outpatient clinic at department of chest medicine, were recruited based on the inclusion and exclusion criteria as detailed bellow; after obtaining written informed consent .The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines. Independent ethics committees approved the study protocol, patient information and consent forms.

Baseline demographic data (age, gender, BMI, associated diseases, habits, family history, drug history) and baseline efficacy variables (pulmonary function test, Mini Asthma quality of life questionnaire[mini AQLQ] scoring and Asthma Control Questionnaire[ACQ-5]) were collected. The patients were randomly assigned in (1:1) ratio to

either of the two groups, randomization was done by using randomized computer tables.

48 patients received budesonide/formoterol 160/4.5 µg one inhalation twice daily, plus additional inhalations as needed (budesonide/formoterol single inhaler therapy), and in the other arm 48 patients received fluticasone /salmeterol 50/250 µg one inhalation twice daily, plus levosalbutamol for rescue medication as needed.

Patients were followed up after 4 weeks of treatment and changes in efficacy parameters like pulmonary function test and mini AQLQ scoring, Asthma Control Questionnaire ACQ-5 were collected and compared between the two arms. A telephonic interview was conducted at 6 months for mini AQLQ scoring, Asthma Control Questionnaire ACQ-5.

Tolerability was assessed based on patient reported adverse experiences.

Inclusion criteria

1. Male and female patients aged above 18 years of age .
2. Patients suffering from moderate asthma with forced expiratory volume in one second (FEV1)≥ 50% or more of predicted value before administration of bronchodialator with a reversibility of 12 % after administering SABA (levosalbutamol).

Exclusion criteria

1. Patients who have a respiratory infection affecting asthma within 1 month of study entry
2. Patients with COPD and other lung diseases which alter the lung function test.
3. A history of smoking ≥10 pack-years
4. Patients taking systemic corticosteroids within 1 month of study entry.
5. Patients with any significant disorder which, in the opinion of the investigator, may put the patient at risk or influenced the results of the study(such as interstitial lung disease , pneumonia).
6. Medications prohibited during the study include any beta2 agonist (except study medication), xanthenes, beta-blocker medication (including eye drops) and inhaled anticholinergics.
7. Patients with uncontrolled diabetes and hypertension
8. Pregnant and lactating women.

Investigations and interventions

- Spirometry, at baseline and at 4 week.

Sample size Calculation

The sample size was estimated using nMaster software, based on the previous study by Bateman ED et al. In which the comparison of FEV1 between the two groups after intervention with 95 % CI , budesonide/formoterol as maintenance and reliever (85.1-88.4) versus fluticasone/salmeterol (82.9-85.9) were taken into consideration. In the present study we needed 48 in each arm to get the similar result with a alpha error of 0.05, with 90% power of the study for a clinically significant difference of 12% FEV1.

Results

Baseline characteristics

The study screened 135 patients, 96 were randomized based on the inclusion and exclusion criteria (Figure 1). For the purpose of the study, patients were divided in two groups the budesonide/formoterol single inhaler therapy group versus fluticasone /salmeterol with as needed SABA (levosalbutamol) group, given as dry powder inhaler/metered dose inhaler in patients with moderate asthma .The baseline demographic characteristics and measures of clinical control between these two groups was similar (Table 1), however there was a statistically significant difference in the duration of asthma and mean MiniAQLQ Score at baseline .Mean Baseline values of Mini Asthma Quality of Life Questionnaire was 3.64 ± 0.840 in budesonide/formoterol group and 4.22±0.793 in fluticasone/salmeterol group with a *p*-value of 0.001.

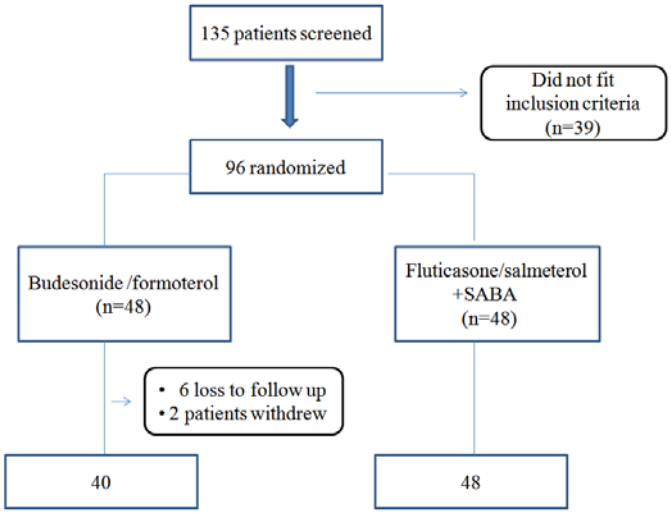

Figure 1. Randomization flow chart

Table 1. Baseline data.

Baseline data	Budesonide -Formoterol	Fluticasone-Salmeterol	P Value
Age (years),Mean±SD	43.78 ± 13.300	39.42 ± 15.006	0.157
Gender n(%)			
• Male • Female	25(62.5) 15(37.5)	23(47.9) 25(52.1)	0.171
Duration of Asthma(years), Mean±SD	8.33(7.062)	2.96(3.427)	0.001*
History of Allergies n(%)	5(12.5)	17(35.4)	0.013*
Family history of Asthma n(%)	9(22.5)	13(27.1)	0.621
Drug history of Aspirin n(%)	4(10)	4(8.3)	0.995
Height (meters), Mean±SD	1.63 ± 0.085	1.59 ± 0.079	0.016*
Weight (Kgs), Mean±SD	63.35 ± 10.584	60.44 ± 10.526	0.201
BMI, Mean±SD	23.98 ± 4.919	24.11 ± 4.454	0.895
MiniAQLQ Score (Baseline) Mean±SD	3.64 ± 0.840	4.22±0.793	0.001*
ACQ-5 Score (Baseline) Mean±SD	2.87 ± 1.1798	2.462±0.765	0.065
Pulmonary Function test			
• FVC (L) Mean±SD	2.39±0.832	2.08±0.931	0.103
• FEV1			
Mean ± SD, L	1.44±0.528	1.26±0.547	0.121
% Predicted, mean ± SD	56.48±14.944	52.52±12.922	0.187
• FEV1/FVC(%) Mean±SD	76.65±10.700	76.56±11.898	0.971
• PEF (L), Mean ± SD Mean±SD	2.93±1.262	2.52±1.234	0.129

• FEF 25-75 (L), Mean ± SD	1.04±0.471	0.86±0.414	0.058

Abbreviations: MiniAQLQ ,Mini asthma quality of life questionnaire; ACQ5, Asthma Control Questionnaire, 5-item version; FVC ,Forced Vital Capacity ;FEV1/FVC, Forced Expiratory Volume in 1 sec/Forced Vital Capacity; FEV1, forced expiratory volume in 1 second; PEF, peak expiratory flow ;FEF25-75%, forced expiratory flow at 25 to 75% of FVC

Pulmonary Function

In the present study, patients in both groups had statistically significant improvements in pulmonary function (FEV1, FVC, FEV1/FVC, PEF) and small airway involvement (FEF 25-75) from baseline. (Table 2, Table 3)

Table 2: Comparison of PFT at Baseline and at 4 weeks in Budesonide/formoterol group.

Evaluation of PFT	Baseline	At 4 weeks	P Value
FCV (L) ,Mean±SD	2.39±0.832	2.63±0.822	0.001***
FEV1			
Mean ± SD, L	1.44±0.528	2.01±0.575	0.001***
% Predicted, mean ± SD	56.48±14.944	79.46±17.606	0.001***
FEV1/FVC (%),Mean±SD	76.65±10.700	92.15±21.320	0.001***
PEF (L), Mean ± SD	2.93±1.262	4.86±1.476	0.001***
FEF 25-75 (L), Mean ± SD	1.03±0.474	2.53±0.592	0.001***

Abbreviations: FVC ,Forced Vital Capacity ;FEV1/FVC, Forced Expiratory Volume in 1 sec/Forced Vital Capacity; FEV1, forced expiratory volume in 1 second; PEF, peak expiratory flow ;FEF25-75%, forced expiratory flow at 25 to 75% of FVC

Table 3: Comparison of PFT at Baseline and at 4 weeks in Fluticasone-Salmeterol group

Evaluation of PFT	Baseline	At 4 weeks	P Value
FCV (L), Mean±SD	2.08±0.931	2.67±0.995	0.001***
FEV1			
Mean ± SD, L	1.26±0.547	2.06±0.825	0.001***
% Predicted, mean ± SD	52.52±12.922	81.01±20.722	0.001***

FEV1/FVC (%),Mean±SD	76.56±11.898	94.78±12.702	0.001***
PEF (L), Mean ± SD	2.52±1.234	5.64±1.501	0.001***
FEF 25-75 (L), Mean ± SD	0.86±0.414	2.03±0.542	0.001***

Abbreviations: FVC ,Forced Vital Capacity ;FEV1/FVC, Forced Expiratory Volume in 1 sec/Forced Vital Capacity; FEV1, forced expiratory volume in 1 second; PEF, peak expiratory flow ;FEF25-75%, forced expiratory flow at 25 to 75% of FVC

On comparing the efficacy of budesonide/formoterol group with the fluticasone/salmeterol group in the present study, patients on budesonide/formoterol group had greater improvements in pulmonary function parameters (FVC,PEF) and small airway involvement (FEF 25-75) which were statistically significant with a p value of 0.015, <0.001, <0.001, <0.001,0.008 respectively. There was no statistical difference in FEV1, FEV1/FVC. (Table 4)

Table 4: Mean Difference of Pulmonary function test variables from baseline

Variables	Budesonide -Formoterol Mean change from baseline		Fluticasone-Salmeterol Mean Difference from baseline		Difference between Groups	P value
	Mean difference (95% CI)	P value	Mean difference (95% CI)	P value		
FVC (L)	-0.238 (-0.264,-0.211)	<0.001	-0.594 (-0.754, -0.434)	<0.001	0.356	0.001***
FEV1% Predicted	-22.980 (-26.079,-19.881)	<0.001	-28.494 (-33.850,- 23.138)	<0.001	5.51	0.077
FEV1/FVC (%)	-15.502 (-22.140, -8.863)	<0.001	-18.221 (-20.407, -16.034)	<0.001	2.719	0.4335
PEF (L)	-1.937 (-2.228, -1.645)	<0.001	-3.121 (-3.400, -2.841)	<0.001	1.184	0.001***
FEF 25-75 (L)	-1.495 (-1.718, -1.271)	<0.001	-1.173 (-1.282, -1.063)	<0.001	0.322	0.008*

Abbreviations: FVC ,Forced Vital Capacity ;FEV1/FVC, Forced Expiratory Volume in 1 sec/Forced Vital Capacity; FEV1, forced expiratory volume in 1 second; PEF, peak expiratory flow ;FEF25-75%, forced expiratory flow at 25 to 75% of FVC

Asthma Control and Quality of Life:

There was an improvement in Asthma Control Questionnaire-5 score from baseline at 4 weeks of 1.655±0.775 in the budesonide/formoterol group and 1.258±0.719 in the fluticasone/salmeterol group which was statistically significant in

both groups with a p-values of 0.001, 0.001 respectively . Budesonide/formoterol group had a greater, mean change from baseline at 4 weeks compared to the fluticasone/salmeterol which was statistically significant with a p-value of 0.015. It was observed that 97.5% patients in the Budesonide/formoterol group achieved a clinically significant improvement of 0.5 on the Asthma Control Questionnaire-5 score compared to 89.6% in the fluticasone/salmeterol group. This difference was statistically significant with a p-value of 0.0001. Similar findings we observed at 6 months. (Table 5)

Table 5: Comparison of ACQ5 score at Baseline and at 4 weeks and 6 months

Evaluation of ACQ5	Budesonide - Formoterol	Fluticasone-Salmeterol	Significance between groups (P Value)
ACQ5 , Mean±SD			
• Baseline	2.87 ± 1.1798	2.462±0.765	
• At 4 weeks	1.216± 0.615	1.204± 0.666	0.065
• At 6 months	1.141± 0.72	1.189± 0.549	0.065
• Mean difference from baseline at 4 weeks	1.655±0.775 Pvalue <0.001*	1.258±0.719 Pvalue <0.001*	0.015**
• Mean difference from baseline at 6 months	1.728±0.455 Pvalue <0.001*	1.273±0.216 Pvalue <0.001*	0.017**
Patients reaching clinically Significant improvement of >0.5 (%)	97.5%	89.6%	0.0001***

There was an improvement of the Mini - Asthma Quality of Life Questionnaire overall mean score at 4 weeks from baseline of 0.897±0.459 in the budesonide/formoterol group and 0.803±0.282 in the fluticasone/salmeterol group which was statistically significant in both groups with a p-values of 0.001, 0.001 respectively . It was observed that 77.5% of patients in the budesonide/formoterol group achieved a clinically significant improvement of 0.5 on the MiniAQLQ Score , compared to 83.3% in the fluticasone/salmeterol group .This difference was not statistically significant with a p-value of 0.490 . Similar findings we observed at 6 months.

However budesonide/formoterol group had greater improvements compared to fluticasone/salmeterol group ,in symptoms, activity ,social ,environment subdomains of miniAQLQ, which was statistically significant with a p value of <0.001,<0.001,<0.001,<0.001.(Table 6)

Table 6: Comparison of MiniAQLQ at Baseline and at 4 weeks.

Evaluation of MiniAQLQ	Budesonide - Formoterol	Fluticasone-Salmeterol	Significance between Groups P Value
Mini AQLQ (Overall score) Mean±SD			
• Baseline	3.64 ± 0.840	4.22±0.793	
• At 4 weeks	4.53± 0.985	5.03± 0.755	
• Mean Change from Baseline at 4 weeks	0.897±0.459	0.803±0.282	0.263
• P value	<0.001	<0.001	
• Mean Change from Baseline at 6 months	0.871±0.239	0.799±0.241	0.263
• P value	<0.001	<0.001	
Patients achieving a clinically significant improvement of> 0.5 (%)	77.5	83.3	0.490
Mini AQLQ Subdomains Mean change from baseline at 4 weeks Mean±SD			

• Symptoms Domain	0.98±0.598	1.0958±0.488	0.001***
• Activity Domain	0.918±0.863	0.5990±0.888	0.001***
• Emotional Domain	0.933±0.720	0.8056±0.470	0.001***
• Environment Domain	0.6917±0.60571	0.583±0.597	0.001***

The adverse events reported in the budesonide/formoterol group were throat pain, headache, nasal congestion, cough, sinusitis, hoarseness of voice , musculoskeletal pain ,nausea and tremor. While in the fluticasone/salmeterol group, throat pain, headache, nasal congestion, cough, sinusitis, hoarseness of voice, musculoskeletal pain, nausea and tremor, diarrhoea, abdominal and anxiety. There were no serious adverse effects in both the groups which led to discontinuation of the study medications. There was no significant difference between side effects between the two groups .(Table 7)

Table 7- Comparison of Adverse effects in two groups studied

Adverse effects	Budesonide -Formoterol	Fluticasone-Salmeterol	P Value
Number of Adverse effects (n)	29	36	0.7539
Adverse effects n(%)			
• Headache	5(12.5)	5(10.4)	0.715
• Nasal congestion	1(2.5)	1(2)	0.876
• Cough	2(2.5)	2(4.1)	0.3464
• Sinusitis	1(2.5)	2(4)	0.3464
• Throat irritation	15(37.5)	12(25)	0.211
• Hoarseness of voice	1(2.5)	3(6.2)	0.3912
• Nausea	1(2.5)	2(4)	0.3464
• Musculoskeletal Pain	2(5)	1(2)	0.70

• Diarrhoea	0	1(2)	0.327
• Abdominal Pain	0	1(2)	0.327
• Anxiety	0	1(2)	0.327
• Tremor	1(2.5)	5(10.4)	0.1219

Adverse effects are statistically similar in two groups with p=0.7539

Statistical Methods

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven1s test for homogeneity of variance has been performed to assess the homogeneity of variance. Student t test (two tailed, dependent) has been used to find the significance of study parameters on continuous scale within each group. Z test has been used to find the significance of study parameters on categorical scale between two or more groups. Statistical software: IBM's Statistical Package for Social Sciences Version 20(SPSS 20.0) was used for the analysis of the data and Microsoft word and Excel have been used to generate tables etc.

Discussion

In the present study , patients in both groups had statistically significant improvements in asthma control (ACQ5), quality of life (miniAQLQ) , improvements in pulmonary function (FEV1,FVC,FEV1/FVC,PEF) and small airway involvement (FEF 25-75) from baseline . These findings are in concurrence with a previous study by Kuna et al , which showed a statistically significant improvement in pulmonary function parameters, asthma control questionnaire, miniAQLQ score in both groups (5).

On comparing the efficacy of budesonide/formoterol group with the fluticasone/salmeterol group in the present study, patients on budesonide/formoterol group had greater improvements in asthma control (ACQ5 overall score , percentage of patients achieving a clinically significant improvement of 0.5 on ACQ5) ,pulmonary function parameters (FVC,PEF) and small airway involvement (FEF 25-75) which were statistically significant with a p value of 0.015, <0.001, <0.001, <0.001,0.008 respectively. There was no statistical difference in FEV1, FEV1/FVC, miniAQLQ overall score between the two groups . Yet, budesonide/formoterol group had greater improvements compared to fluticasone/salmeterol group ,in activity ,social ,environment subdomains of miniAQLQ, which was statistically significant with a p value of <0.001,<0.001,<0.001. The incidence of side effects were similar in both groups with a p value of 0.7539. There were no serious adverse effects in both the groups which led to discontinuation of the study medications. A trial by Vogelmeier et al demonstrated that , both regimens provided clinically relevant improvements in asthma control, quality of life and pulmonary function parameters compared with baseline; no statistically significant differences between the treatment groups .On comparing the findings in the present study with Vogelmeier et al similar results have been demonstrated however in the present study, the budesonide/formoterol group had greater improvements in asthma control , quality of

life and, pulmonary function parameters than the fluticasone salmeterol group, which were statically significant.(4)

The improvements in small airway function are similar to results from a study by Hozawa et al according to which , the patients on budesonide/formoterol twice daily had significantly improved parameters of small airway impairment (FEF 25-75) and ACQ5 scores ,compared with Fluticasone/salmeterol group. (6)

Several steroids and beta2-agonists (long- and short-acting) as well as combinations of these treatments are available in a single inhaler to be used twice a day, with a separate inhaler as a reliever as and when needed (for patients in Step three or higher, according to Global Initiative for Asthma (GINA) guidelines).(1) Budesonide/formoterol is licensed for use as maintenance and reliever therapy from a single inhaler, called single inhaler therapy (SIT) . SIT can be prescribed at a lower dose than other combination therapy because of the additional steroid doses being received as reliever therapy. It has been suggested that using SIT improves compliance and hence reduces symptoms and exacerbations, but it is unclear whether it increases side effects associated with the use of inhaled steroids.(4)(7)(8) Although efficacy and safety of both combinations have been proved individually, head to head comparisons between the two combinations do not arrive at a consensus.(7)(9)(10)(11). Findings from a recent Systemic review by Kew et al, compared SIT versus fixed-dose combination inhalers plus SABA as reliever , SIT reduces the number of people having asthma exacerbations requiring oral steroids and the number requiring hospitalisation or an emergency room visit compared with fixed-dose combination inhalers. Evidence for serious adverse events was unclear. The mean daily dose of inhaled corticosteroids (ICS) in SIT, including the total dose administered with reliever use, was always lower than that of the other combination groups. This suggests that the flexibility in steroid administration that is possible with SIT might be more effective than a fixed-dose combination by increasing the dose only when needed and keeping it low during stable stages of the disease.(7)

The effectiveness of the single inhaler therapy is due to the addition of formoterol to ICS , which has proven effective in improving asthma control as maintenance therapy in asthma patients and due to its rapid onset of action also as a reliever medication, significantly reducing the exacerbation rate and improving symptoms. Formoterol has a steep dose response relationship ,double-dose formoterol has greater additional bronchoprotective effects, which may be important in preventing exacerbations, than double-dose salmeterol.(12)(13) Due to the slow onset of action and the lack of a steep dose–response relationship, salmeterol is not considered to be suitable for use as a reliever medication. This difference in the LABA components that allows budesonide/formoterol to be used as both a maintenance and reliever therapy.(14)

Some of the strengths of the present study are ,the randomized nature ,a hospital based study which is more reflective of real world conditions ,the use of patient reported outcomes as efficacy measurements as well as objective measurements like pulmonary function test and researched focused on investigating treatment regimens which could contribute to the improvement in compliance and asthma control in moderate asthma patients .Few limitations of the present study are , the small sample size , the differences in MiniAQLQ at baseline , the short duration of follow up.

Thus, the present study has demonstrated that there Budesonide/formoterol maintenance and reliever therapy showed greater improvements in key aspects of asthma control , pulmonary function and in the emotional , social and environmental domains of quality of life. With its increased efficacy and ease of administration , it does provide an improvement in patients with moderate asthma .Future research may study the use of symptom-driven as-needed ICS/fast-onset LABA therapy in patients with moderate asthma, as a novel approach which could improve adherence to

treatment and asthma control compared with the standard approach of ICS/LABA with as needed SABA for relief.

Conclusion

The two regimens, budesonide/formoterol maintenance and reliever therapy as well as fluticasone/salmeterol plus as needed SABA , both demonstrated statistically significant improvements in pulmonary function parameters ,asthma control and quality of life from baseline . Budesonide/formoterol maintenance and reliever therapy showed greater improvements in key aspects of asthma control (ACQ5), pulmonary function and in the symptoms, activity, emotional, social and environmental domains of quality of life. It can be concluded from this study that single-inhaler therapy with budesonide/formoterol for maintenance and relief, having an increased efficacy and ease of administration, does provide an improvement in patients with moderate asthma.

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