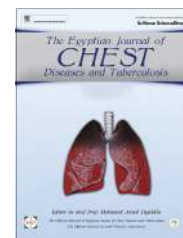




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ORIGINAL ARTICLE

Effect of Buteyko breathing technique on patients with bronchial asthma

Zahra Mohamed Hassan ^a, Nermin Mounir Riad ^{b,*}, Fatma Hassan Ahmed ^c

^a Department of Physical Therapy, Cairo University, Egypt

^b Chest Department, Faculty of Medicine, Ain Shams University, Egypt

^c Faculty of Physical Therapy, Cairo University, Egypt

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KEYWORDS

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Abstract A new dawn is emerging by recognizing that correct breathing volume is fundamental to maintaining good health, the new beginning is based on the life's work of Russian scientist professor Konstantin Buteyko.

The Buteyko breathing technique method as suggested by Professor Buteyko helps to decrease the number and severity of attacks as well as the dosage of medication. As a result of this therapy, the indicators of acid-alkali balance and lung ventilation improved.

The aim of this study was to assess the effect of Buteyko breathing technique on patients with bronchial asthma.

Forty patients with bronchial asthma participated in this study, their age ranged between 30 and 50 years.

They were divided into two equal groups, group (A) received Buteyko breathing technique (BBT), and the medications prescribed by the physician, while group, (B) did not perform any physical therapy program just their medications prescribed by the physician. The program continued for 6 weeks (2 sessions per week except the 1st week was 4 sessions per week). Peak expiratory flow rates (PEFR), Control pause test and asthma daily symptoms (asthma control questionnaire) were measured at the beginning and after the treatment program for both groups.

The results of this study: revealed a significant decrease in asthma daily symptoms, a significant improvement in PEFR, and Control pause test in group (A), while there was insignificant change in group (B).

* Corresponding author. Tel.: +20 1008849776.

E-mail address: dr.nermine.monir@gmail.com (N.M. Riad).

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It can be concluded that BBT produce a significant improvement for patients with bronchial asthma as regard daily symptoms, PEFR and Control pause test.

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Introduction

Asthma is a serious global health problem. People of all ages in countries throughout the world are affected by this chronic airway disorder that, when uncontrolled, can place severe limits on daily life and is sometimes fatal. The prevalence of asthma is increasing in most countries, especially among children. Asthma is a significant burden, not only in terms of health care costs but also of lost productivity and reduced participation in family life [1]. Complementary and alternative therapies (CATs) are widely used by patients with chronic illnesses. CAT use amongst patients with asthma appears particularly high, with rates of up to 42% reported in some populations. The range of CATs employed is wide; however, CAT research in asthma is characterized by a lack of adequately sized randomized controlled trials [2]. (see Figs. 1–3 and Tables 1–6)

Dr. Konstantin Buteyko is the developer of the fundamentally new, drug free therapy for bronchial asthma, well known today as The Buteyko Method. He is the Ukrainian born medical scientist and medical practitioner who discovered that the main cause of bronchospasm in bronchial asthma is CO₂ deficiency in alveolar air, resulting from hyperventilation and low metabolic activity. He demonstrated that hyperventilation is the main element in the etiology and pathogenesis of asthma. He was the first to describe this mechanism in 1962 when he worked as a Director of the research laboratory of functional diagnostics in the Siberian Branch of the Academy of Medical Science (Institute of Experimental Biology and Medicine, Novosibirsk). The understanding and knowledge of this mechanism was the basis for the development of the Buteyko Method, which reverses not only asthma but also all other hyperventilation related diseases often associated with asthma, such as bronchitis, coughing, allergy, rhinitis, high blood pressure etc., [3].

With asthma, excess breathing has 4 primary effects, according to the Buteyko Institute of Breathing and Health in Australia.

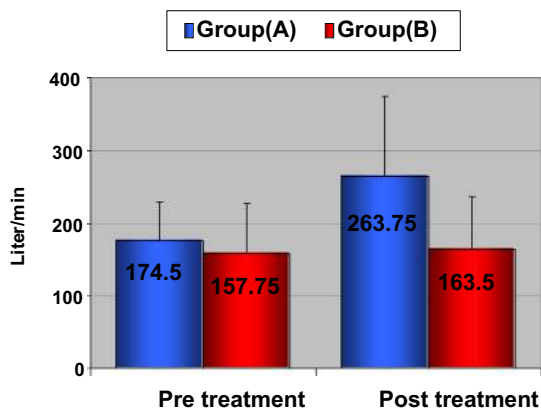


Figure 1 Mean and ±SD of Peak expiratory flow rate pre and post treatment in both group, (A) and group (B).

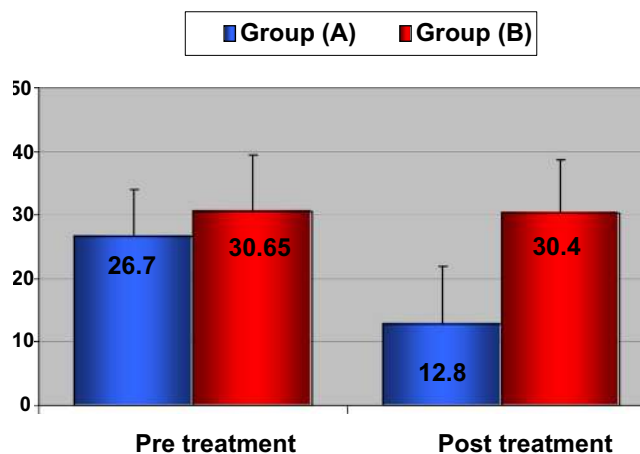


Figure 2 Mean and ±SD of Asthma control questionnaire pre and post treatment of groups (A, B).

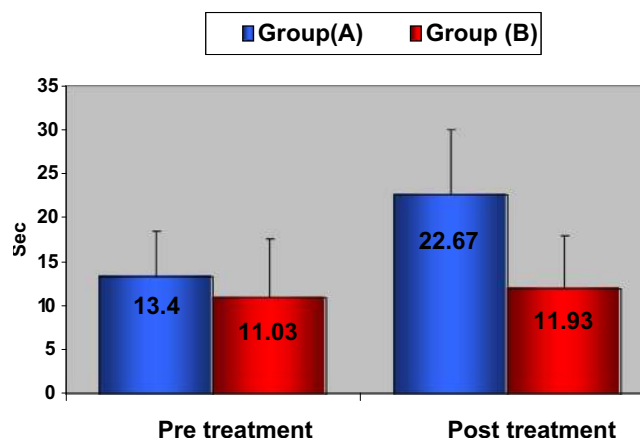


Figure 3 Mean and ±SD of Control pause test pre and post treatment of groups (A,B).

Table 1 Peak expiratory flow rate pre and post treatment of group (A).

Group A (study group)	Peak expiratory flow rate	
	Pre treatment	Post treatment
Mean	174.5	263.75
± SD	± 54.14	± 110.41
Mean difference	89.25	
DF	19	
t-value	3.8	
P-value	0.001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant, DF: degree of freedom.

Table 2 Peak expiratory flow rate pre and post treatment of group (B).

Group B (control group)	Peak expiratory flow rate	
	Pre treatment	Post treatment
Mean	157.75	163.5
±SD	± 69.44	± 72.56
Mean difference	5.75	
DF	19	
t-value	0.96	
P-value	0.34	
S	NS	

*SD: standard deviation, P: probability, S: significance, NS: non-significant, DF: degree of freedom.

Table 3 Mean and ±SD, t and P values of Asthma control questionnaire pre and post treatment of group (A).

Group A (Study Group)	Asthma control questionnaire	
	Pre treatment	Post treatment
Mean	26.7	12.8
±SD	± 7.21	± 9.19
Mean difference	13.9	
DF	19	
t-value	7.14	
P-value	0.0007	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant, DF: degree of freedom.

Table 4 Mean and ±SD, t and P values of Asthma control questionnaire pre and post treatment of group (B).

Group B (control group)	Asthma control questionnaire	
	Pre treatment	Post treatment
Mean	30.65	30.4
±SD	± 8.81	± 8.27
Mean difference	0.25	
DF	19	
t-value	0.9	
P-value	0.3	
S	NS	

*SD: standard deviation, P: probability, S: significance, NS: non-significant, DF: degree of freedom.

- 1- Carbon dioxide levels decrease. Since higher levels of carbon dioxide signal smooth muscle to relax and dilate, low levels can cause the smooth muscle around the bronchioles (tubes that carry air into and out of the lungs) to spasm, resulting in chest tightness and difficulty in exhaling.
- 2- Oxygen is released from the blood more slowly, causing breathlessness.
- 3- Mast cells, immune-system components found in connective tissue, become overly sensitive to perceived allergens and release large amounts of histamine, which causes inflammation.
- 4- Airways dry out and become inflamed, encouraging mucus formation [4].

Table 5 Mean and ±SD, t and P values of Control pause test pre and post treatment of groups (A).

Group A (study group)	Control pause test	
	Pre treatment	Post treatment
Mean	13.4	22.67
±SD	± 5.19	± 7.38
Mean difference	9.27	
DF	19	
t-value	5.9	
P-value	0.0005	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant, DF: degree of freedom.

Table 6 Mean and ±SD, t and P values of Control pause test pre and post treatment of group (B).

Group B (control group)	Control pause test	
	Pre treatment	Post treatment
Mean	11.03	11.93
±SD	± 6.67	± 6.01
Mean difference	0.89	
DF	19	
t-value	1.73	
P-value	0.09	
S	NS	

*SD: standard deviation, P: probability, S: significance, NS: non-significant, DF: degree of freedom.

The Buteyko Breathing Technique (BBT) is a CAT used by asthma patients that has enjoyed increasing popularity over recent years. Its aim to reverse chronic hyperventilation. One small, randomized controlled trial of the BBT showed marked reduction in asthma drug consumption among patients in Brisbane, Australia A further trial, based on the use of a BBT video has also demonstrated BBT is effective in reducing β2-agonist use [5].

Purpose of the study

To assess the effect of the Buteyko breathing technique on peak expiratory flow rate, asthma daily symptoms, the Control pause and medications in patients with bronchial asthma.

Subjects, instrumentations and methods

Subjects

Forty patients of both sex, suffering from bronchial asthma for 3 years or more were included in this study. They were selected from 23rd of July Chest Hospital and assigned an ethical committee approval. All patients were examined and diagnosed by the physicians of the hospital. They were assigned into two groups equally in numbers, as group (A) and group (B).

Group (A). The study group consists of 20 patients who received the medical treatment and the designed Buteyko program for 6 weeks.

Group (B). The control group consists of 20 patients received the medical treatment only and didn't participate in any physical therapy program during the time of the study.

Inclusion criteria.

- 1- The patients would be previously diagnosed as bronchial asthma for 3 years ago or more.
- 2- The age of the patients ranged between 30 and 50 years old.

Exclusion criteria.

- 1- Previous instruction in the Buteyko method.
- 2- Cardiac diseases.
- 3- Mental retarded patients.

Instrumentations

(A) For evaluation

1. Standard wright peak flow meter. A standard Mini Wright peak flow meter is a portable, inexpensive, hand-held device used to measure how air flows from lungs in one "fast blast." the meter measures the ability to push air out of lungs.
2. Stop watch.
3. Height tape measurement.

(B) For Treatment

1. Stop watch

Methodology

The purpose of the study, methodology and experimental protocol was explained to every subject shared in the study and they agreed to share in this study. Informed consent was taken from each patient.

(A) Evaluation procedures

1. Measurement of height:
 - Each patient stand facing the height tape measurement with straight back and bare feet.
 - The measurement was made to calculate the predicted PEFR.
2. The predicted PEFR: The predicted PEFR was calculated by the following equation

$$\text{PEFR(L/min)} = [\text{Height(cm)} - 80] \times 5.$$

3. Measurement of PEFR:

- Each patient was examined in the upright sitting position.
- The cartoon mouth piece was adjusted to the mouth piece of the peak expiratory flow meter.
- The pointer was switched to zero.
- Instruct the patient to hold the peak flow meter level (horizontally) and to keep his fingers away from the pointer.
- Ask the patient to take a deep breath and close his lips firmly around the cartoon mouthpiece.
- Ask the patient to blow as hard as he can – as if he was blowing out candles on a birthday cake.

- Ask the patient to remember it is the speed of his blow that is being measured.
- Take the reading.
- The pointer was switched back to zero.
- Each patient repeated this three times and the highest reading was recorded.
- Each patient was assessed for 4 consequent days and the highest reading was recorded.

4. Assessment of asthma control questionnaire

The asthma control questionnaire was developed and validated to measure asthma control in adults [6].

But in the study described here the PEFR was used instead of FEV1 and that was one of the limitations of this study.

A study was conducted with the aim of comparing the measurement properties of the clinic-completed asthma control questionnaire with those of the Asthma Control Diary. The diary is composed of questions and response options almost identical to those of the questionnaire, but uses PEFR instead of FEV1 as the measure of airway caliber [6].

The PEFR% was obtained by dividing the measured PEFR over the predicted PEFR and by it to 100 according to the following equation.

$$\text{PEFR\%} = \frac{\text{measured PEFR} \times 100}{\text{Predicted PEFR}}$$

5. Measurements of Control pause breathing test:

- a. Sit in an upright chair and adopt a good posture. Relax your shoulders and rest your lower back against the back of the chair.
- b. Do not change your breathing before taking your CP. Take a small breath in (two seconds) and a small breath out (three seconds). Hold your nose on the 'out' breath, with empty lungs but not too empty. Holding your nose is necessary to prevent air entering into the airways.
- c. Count how many seconds you can comfortably last before you need to breathe in again. Hold your breath until you feel the first need to breathe in. Release your nose and breathe in through it.
- d. Your first intake of breath after the CP should be no greater than your breath prior to taking measurement; you should not hold your breath for too long as this may cause you to take a big breath after measuring the CP [7].

Treatment procedures

Group (A)

The patients of this group received the designed BBT, and they were on their medical treatment.

Each patient was trained by Buteyko breathing technique twice per week, and the session was about (20 min).

The first week each patient of this group trained by Buteyko breathing technique intensively for 4 days then the following 5 weeks were 2 sessions per week.

The time of the session was in the morning at least two hours after meals.

Each patient performed the technique by himself at home twice daily (in the morning and in the evening, at least 2 h after meals) during the time of the study.

The used Buteyko Technique

Step1: The “Control pause” breathing test:

Sit in an upright chair and adopt a good posture. Relax your shoulders and rest your lower back against the back of the chair.

Do not change your breathing before taking your CP. Take a small breath in (2 s) and a small breath out (3 s). Hold your nose on the “out” breath, with empty lungs but not too empty. Holding your nose is necessary to prevent air entering into the airways.

Count how many seconds you can comfortably last before you need to breathe in again. Hold your breath until you feel the first need to breathe in. Release your nose and breathe in through it.

Your first intake of breath after the CP should be no greater than your breath prior to taking measurement; you should not hold your breath for too long as this may cause you to take a big breath after measuring the CP [7].

Step 2: Shallow breathing

- Sit up straight.
- Monitor the amount of air flowing through your nostrils by placing your finger under your nose in a horizontal position. Your finger should lie just above your top lip, close enough to your nostrils so that you can feel the airflow, but not so close that the air-flow is blocked.
- Now, breathe air slightly into the tip of your nostrils. For example, just take enough air to fill your nostrils and no more. Breathe in a flicker of air (maybe 1 cm) with each breath.
- As you exhale, pretend that your finger is a feather. Breathe out gently onto your finger so that the feather does not move.
- When you breathe out, the more warm air you feel, the bigger you are breathing. Concentrate on calming your breath to reduce the amount of warm air you feel on your finger.
- As you reduce the amount of warm air onto your finger, you will begin to feel a need or want for air.
- Try to maintain the need for air for about 4 min [7].

Step 3: Putting it together

Take Control pause.

Reduced breathing for 4 min.

Wait 2 min and take Control pause.

Reduced breathing for 4 min.

Wait 2 min and take Control pause.

Reduced breathing for 4 min.

Wait 2 min and take Control pause.

Reduced breathing for 4 min.

Wait 2 min and take Control pause [7].

Group (B)

The patients of this group received their medical treatment only and they did not participate in any physical therapy program during the time of the study. Then evaluation was made again at the last session.

The study was limited by the small sample size, the availability of facilities specialized in evaluation and treatment of bronchial asthma and that was the cause to use the PEFR instead of FEV1 in the evaluation of patients, some patients do not believe in efficacy of chest physical therapy as helpful treatment for bronchial asthma, the patient ability to complete the whole program(6 weeks), psychological and physiological status of patients may influence severity and recurrence of asthma attacks and that affect the treatment and evaluation and lastly the patient may not do the program at home.

Statistical analysis

Statistical Package for social science (SPSS) program version 9.0 was used for analysis of data. Data was summarized as mean, SD. One way ANOVA was done for analysis of more than two variables followed by post HOCC test for detection of significance. *P*-value is considered significant if <0.05 . The collected data statistically analyzed by using *T*-test:

Paired *t*-test used to compare pre with post for each group.
Unpaired *t*-test to compare group A and group B.

Results

This study was conducted on 40 patients suffering from bronchial asthma were assigned randomly into two groups.

Twenty patients were included in group (A) (7 females and 13 males). Their mean ages were (42.2 ± 7.12) years, and mean height (163.54 ± 5.11) cm.

The other twenty patients were included in group (B) (11 females and 9 males). Their mean ages were (40.35 ± 8.01) years, and mean height (160.51 ± 7.66) cm.

There was no significant difference between both groups in their ages, and heights where their *t* and *P*-values were (0.77, 0.44), and (1.47, 0.15), respectively.

There was an increase in peak expiratory flow rate with 51% in group (A) and an increase by 3.6% in group (B). There was a decrease in the results of asthma control questionnaire with 52% in group (A) and with 0.8% in group (B). There was an increase in the Control pause test with 69% in group A and by 8% in group B.

In the present study the percentage change in Inhaled steroids was decrease of the dose in 33% of group A and 15% in group B.

Discussion

In the present study 40 asthmatic patients were subdivided randomly according to GINA guidelines severity classification in group(A) (2 severe patients, 4 moderate patients, 9 mild patients, and 5 intermittent patients), while in group (B) (4 severe patients, 4 moderate patients, 7 mild patients, and 5 intermittent patients).

In the present study there was an improvement in PEFR with 51% in group (A) and 3.6% in group (B).

This is come in support with an old study by Buteyko et al [8] included 52 children (34 in-patients and 18 out-patients; 3–15 years old) with regular asthma attacks (once per day or more); 41 of them had pneumonia, 27 rhinitis, 36 chronic tonsillitis. All had problems with breathing through the nose, pal-

pitations, and were bronchodilator users. In 1–5 days the patients were able to stop the attacks, cough, blocked nose, and wheezing, using the method. Observations in 1–3 months showed considerable improvements (cessation of heavy attacks or a total disappearance of the symptoms) in 83%, some improvement (less heavy attacks and considerable reduction in medication) in remaining 17%. Their average CP increased from 4 to 30 s, aCO₂ from 25 to 36 mm Hg. Blood pressure normalized, forced expiratory volume raised over 5 times. Significant increases in lung volume, expiratory speed.

Patrick McHugh et al [9] recorded no change in forced expiratory in his study.

However, the trial recorded no adverse effects from the use of Buteyko program.

Even though no study has indicated exactly why Buteyko is so effective at controlling asthma, if a drug could show these results, then it is likely that it would be used widely in asthma control. In Cooper et al [10] study there was no difference seen between groups in FEV₁, the study was between group used Buteyko breathing technique and the other group used Pink City Lung Exerciser (PCLE) to mimic pranayama.

In the present study, the result of Buteyko breathing technique showed a decrease in asthma daily symptoms with 52% and 0.8% in group (A) and (B), respectively.

Bowler et al. [11] study showed 54% improvement in quality of life questionnaire at 6 weeks. Cowie et al. [12] study conducted in Canada in 2008, took 129 patients with asthma and randomized them to receive a set of breathing exercises from either a Buteyko practitioner or a chest physiotherapist. In the Buteyko group the proportion of patients achieving good control of their asthma increased from 40% at baseline to 79% at 6 months. David Holmes [13] study conducted to assess the Buteyko and chest physical therapy, the initial level of disease control was higher than expected with 40% of the Buteyko and 44% of the control groups showing disease control as assessed by questionnaire. At 6 months follow-up, the percentage of patients with asthma control had improved to 79% in the Buteyko group and 72% in the control group and the study concluded that The Buteyko technique or an intensive program delivered by a chest physiotherapist appear to provide additional benefit for adult patients with asthma who are being treated with inhaled corticosteroid. The results of the present study come in support with a study by Robert Cowie [14] who applied Buteyko techniques for 6 months asthma control improved from 41% to 75%.

In a study by Opat et al [5] the results demonstrated a significant improvement in quality of life among those assigned to the BBT compared with placebo. This study was designed to examine whether the BBT, as taught by a video, is an efficacious asthma therapy. Thirty-six adult subjects with mild to moderate asthma were randomized to receive either a BBT or placebo video to watch at home twice per day for 4 weeks. Asthma-related quality of life, peak expiratory flow rate (PEFR), symptoms, and asthma medication intake were assessed both before and intervention.

The percentage change of Control pause test was 69% in group A and 8% in group B. This came in support with Buteyko et al [8] study in Sechenov's Medical Institute, Moscow that the average breath holding time increased from about 3–6 s to over 30 s.

In the present study the percentage change in inhaled steroids was decrease of 33% in Group A and decrease 15% in

group B. Cowie RL et al [15] study conducted in Canada in 2008, took 129 patients with asthma and randomized them to receive a set of breathing exercises from either a Buteyko practitioner or a chest physiotherapist. In the Buteyko group the proportion of patients achieving good control of their asthma increased from 40% at baseline to 79% at 6 months. This improvement was associated with a statistically significant reduction in the average dose of inhaled steroid. Improvements in asthma control were also seen in the group treated with chest physiotherapy. BBT has clinical and potential pharmacoeconomic benefits that merit further study.

Cooper et al [10] study were conducted on ninety patients with asthma taking an inhaled corticosteroids they were randomized to Eucapnic Buteyko breathing, use of a Pink City Lung Exerciser (PCLE) to mimic pranayama, or a PCLE placebo device. Subjects practiced the techniques at home twice daily for 6 months followed by an optional steroid reduction phase. The results were sixty nine patients (78%) completed the study. There was no significant difference in placebo device between the three groups at 3 or 6 months. Symptoms remained relatively stable in the PCLE and placebo groups but were reduced in the Buteyko group. Median change in symptom scores at 6 months was 0 (interquartile range –1 to 1) in the placebo group, –1 (–2 to 0.75) in the PCLE group, and –3 (–4 to 0) in the Buteyko group ($p = 0.003$ for difference between groups). Bronchodilator use was reduced in the Buteyko group by two puffs/day at 6 months; there was no change in the other two groups ($p = 0.005$). No difference was seen between the groups in FEV₁, exacerbations, or ability to reduce inhaled corticosteroids. They concluded that The Buteyko breathing technique can improve symptoms and reduce bronchodilator use but does not appear to change bronchial responsiveness or lung function in patients with asthma. No benefit was shown for the Pink City Lung Exerciser.

Slader et al. [16] study had some criticism from Buteyko supporters the study was on something that is similar to Buteyko and confirms the findings of previous trials. This was the first trial to use an active control group, by comparing the Buteyko group with a similar, but not identical, set of breathing exercises. group A exercises were “Buteyko-like”. Group B were breathing exercises designed to avoid impact on upper body muscle strength. In both groups, reliever use decreased by 86%. Quality of life measurements Quality of life measurements, lung function and airway responsiveness were unchanged after 14 weeks. The group constructed an in-house device to assess route of breathing and end-tidal CO₂ levels, neither of which changed significantly over the course of the trial. The study concluded that Breathing techniques may be useful in the management of patients with mild asthma symptoms who use a reliever frequently, but there is no evidence to favor shallow nasal breathing over non-specific upper body exercises.

Robert Cowie [14] applied Buteyko techniques for 6 months, he found that there were Improvement in Asthma control from 41% to 75%, Decrease of ICS (Inhaled corticosteroids) by 39% and Elimination of ICS was 21% and he was astonished and also very pleased with the excellent result. There is no disruption of their life at all by their disease: normal activities; not waking at night; not needing to use any reliever medications. The neat thing about it is that it has no side effects. It's very safe. The Buteyko technique certainly has been shown to be an important adjunct to treatment.

This improvement in group A, who treated by BBT and medications, come in support with the result of The study by Bowler et al. [11], who demonstrated inhaled steroid reduction of 49% for the BBT group and 0% for the control group at three months, 95% reduction of β_2 -agonist

Use in the BBT group and a 7% reduction in the control group at three months. Also, in a study by Patrick McHugh et al [9], aimed to measure safety and effectiveness, rather than why Buteyko works. It recorded no change in forced expiratory volume. However, there was an 85% reduction in β_2 -agonists and a 50% reduction in steroid use amongst people who had used the Buteyko method for, and a 1% increase for the control group at six months. A reduction in β_2 -agonist use, of 37% in the control group at six months. The trial recorded no adverse effects from the use of Buteyko. Even though no study has indicated exactly why Buteyko is so effective at controlling asthma, if a drug could show these results, then it is likely that it would be used widely in asthma control.

In conclusion

The results of this study support the good effect of BBT on patients with bronchial asthma. It significantly decrease the recurrence and the severity of the main bronchial asthma symptoms (nocturnal waking, morning symptoms activity limitation, shortness of breath, wheezing, PEFr% predicted, and Inhaled Corticosteroids). And it significantly increase PEFr. BBT will improve patient's function level and the capacity for independent living by decreasing the severity of asthma symptoms and recurrence of asthma attacks.

References

- [1] GINA (Global Strategy for Asthma Management and Prevention), 2008. <<http://www.ginasthma.org>>.
- [2] E. Holloway, F.S. Ram, Breathing exercises for asthma, Cochrane Database Syst. Rev. (3) (2000) CD001277.
- [3] Andrey Novozhilov, "Living without Asthma" Buteyko breathing clinic self help Buteyko Books, 2008. Web: <<http://www.ButeykoClinic.com>>, Email: info@buteykoclinic.com.
- [4] Buteyko Institute of Breathing and Health, Conditions: Asthma, 2007. Available at: <http://www.buteyko.info/asthma_buteyko.asp?>.
- [5] A.J. Opat, M.M. Cohen, M.J. Bailey, M.J. Abramson, A clinical trial of the Buteyko breathing technique in asthma as taught by a video, *J. Asthma* 37 (2000) 557–564.
- [6] F. Elizabeth, Juniper, M. Paul, J. Penel Lope, N. Jeremy, Measuring asthma control clinic questionnaire or daily diary?, *Am J. Respir. Crit. Care Med.* (2000) 162.
- [7] Patrick Mckeown, "close you mouth" Buteyko breathing clinic self help Buteyko Books. 2009. Published by: Buteyko Books Loughwell, Moycullen, Co.Galway Web: www.ButeykoClinic.com Email:info@buteykoclinic.com Tel Intl: 00 353 91 756229.
- [8] K. Buteyko, V. Genina, The Results of BVB Method Trial at The Department of Children's Diseases, in: S. Sechenov (Ed.), First Moscow Medical Institute, 1981.
- [9] Patrick McHugh, F. Aitcheson, B. Duncan, F. Houghton, Buteyko breathing technique for asthma: an effective intervention. *N. Z. Med. J.* 116 (2003) 1187. URL: <<http://www.nzma.org.nz/journal/116-1187/710>>.
- [10] S. Cooper, J. Osborne, T. Harrison, A. Tattersfield, Effect of mouth taping at night on asthma control—a randomised single-blind crossover study, *Respir. Med.* 103 (2009) 813, PMID 19285849.
- [11] S. Bowler, A. Green, C. Mitchell, Buteyko breathing and asthma: a controlled trial, *Med. J. Aust.* 169 (1998) 575–578.
- [12] R.L. Cowie, D.P. Conley, M.F. Underwood, P.G. Reader, A randomised controlled trial of the Buteyko technique as an adjunct to conventional management of asthma, *Respir. Med.* 102 (2008) 726, PMID 18249107.
- [13] David Holmes, Both Buteyko and chest physiotherapy improve asthma control, *Respir. Med.*, 2008, Advance online publication.
- [14] Robert Cowie, Buteyko Breathing Technique, vol. 3, Medical Trial Foothills Hospital Medical trial, Calgary, Alberta, The American Thoracic Society, 2006, p. A530.
- [15] R.L. Cowie, D.P. Conley, M.F. Underwood, P.G. Reader, A randomized controlled trial of the Buteyko technique as an adjunct to conventional management of asthma, *Respir. Med.* 102 (2008) 726, PMID 18249107.
- [16] C. A Slader, H.K. Reddel, L.M. Spencer, E.G. Belousova, C.L. Armour, S.Z. Basnic-Anticevich, F.C.K. Thien, C.R. Jenkins, Breathing techniques as treatment for asthma, *Thorax J.* (2006) 1–7, Doi: 101136/thx2005 054767.