Self-Management of Asthma Through Normalisation of Breathing

The Role of Breathing Therapy

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Abstract

The Buteyko Breathing Method is a self-management therapy for asthma. The author is a member of the research team for the clinical trial at Brisbane's Mater Hospital, a physiotherapist and accredited Buteyko Practitioner.

The clinical trial compared the efficacy of the Buteyko Breathing Method with conventional treatment of asthma. The control group, was on a regime of medical management, physiotherapy exercises, and asthma education, recorded no improvement. The Buteyko Method group significantly reduced bronchodilators (90%), asthma symptoms, and steroid medication, with significant improvements in their quality of life.

The initial clinical testing demonstrated resting hyperventilation and hypocapnia in all 39 participants. The Buteyko techniques teach asthma sufferers to reduce their breathing to normal levels. Statistical analysis after 3 months showed a significant difference between the groups' ventilation and a correlation between reduction in minute volumes and bronchodilator usage for the Buteyko group.

The paper explains the study findings and recommends that everyone involved with the management of asthma respond to its unequivocal results. In particular, there is a need to review traditional management practices which may encourage asthma sufferers to increase their breathing volume. This is inappropriate if their asthma arose from or is exacerbated by over breathing. The Buteyko Method stems from an orthodox approach to respiration. It recognises hyperventilation and hypocapnia as causes of physiological distress and treats it appropriately and effectively by normalising breathing.

Introduction

The first Australian medical research trial of the Buteyko Breathing Method commenced in December 1994 (Bowler et al, 1995) at the Mater Hospital, South Brisbane Queensland, and was organised by the Australian Association of Asthma Foundations and Buteyko Australia Pty Ltd.

This paper outlines that study, highlights interesting findings from the research, and discusses the Buteyko Breathing Method as a self-management therapy for asthma sufferers and is not intended as a complete record of all clinical results.

The theoretical background to the Buteyko Breathing Method (Buteyko, 1990) links over breathing, i.e. hyperventilation, and hypocapnia (low alveolar carbon dioxide ($C0_2$)) with asthma, since a deficit of CO_2 may cause bronchoconstriction. The Buteyko Breathing Method teaches asthma sufferers to normalise their breathing in order to overcome and prevent asthma symptoms. With long-term practice and reconditioning, Buteyko asserts that sufferers improve asthma control and require less medication (see Appendix 1).

Hyperventilation of physiological origin is known to accompany asthma attacks. Hyperventilation is also known to cause asthmatic episodes (Hibbert, 1988). What is unknown is how prevalent 'hidden' or undiagnosed hyperventilation and hypocapnia are in asthma sufferers in the period between attacks.

To investigate Buteyko's theory, end-tidal CO_2 (an approximation for alveolar CO_2) and minute volume (the volume of air breathed per minute at rest), were measured in this study. Work by Hormbrey et al (1988) found significantly higher minute ventilation and lower end-tidal CO_2 in asthma subjects than in control subjects.

The Brisbane study followed considerable public interest in the Buteyko breathing Method in Australia and New Zealand, and much anecdotal evidence supporting the claims of its effectiveness in the management of asthma (Graham et al, 1995). With the rising morbidity of asthma in these two countries, research into the method was recognised as being important.

The Brisbane study entitled "Buteyko Breathing Techniques and asthma: A Controlled Trial of Efficacy Compared to Conventional Treatment" was a controlled, randomised study comparing the Buteyko breathing technique with a placebo breathing technique and conventional management. Symptoms, quality of life, lung function and medication were measured.

The protocol for the study established two aims:-

(i) To determine the efficacy of the Buteyko Method in controlling airway obstruction and the symptoms of asthma and in reducing the need of bronchodilators in patients with asthma.

(ii) To determine the efficacy of the Buteyko Method in reducing the need for inhaled and systemic corticosteroid and cromoglycate therapy in these patients.

Methodology

Thirty-nine subjects aged from 12 to 70 years were recruited in November 1994 for the clinical trial. They were accepted if they reported a history of asthma and were taking significant doses of asthma medications. They were randomly allocated to treatment groups, Buteyko or control; subjects were stratified by daily $ß_2$ agonist (bronchodilator) usage.

Training was undertaken simultaneously in two separate groups, in different rooms of the same building. Teaching occurred over seven days, each session lasting 60-90 minutes. Phone contact with the instructor after the teaching week was permitted. For three months blinding was to be maintained so that neither group was aware of which type of treatment they, were being taught.

Patients kept diary cards at home on which they recorded daily peak expiratory flow, (PEF), medication usage, and scored their symptoms (3 = maximal symptoms, 0 = no symptoms). Throughout the study, including during the one month run-in period, bronchodilator medication was to be used on an 'as required' basis only. Attempts were made to minimise the daily usage in both groups.

During the initial 6 weeks of the study subjects were asked not to alter inhaled steroid dose. After the clinic review, six weeks after tuition, subjects using one dose a day or less of short acting $ß_2$ agonists were directed to reduce their inhaled steroid dose according to the protocol for the study.

The 20 in the control group were given standard asthma education, and standard physiotherapy techniques (including abdominal breathing exercises, relaxation and coughing techniques). The 19 in the Buteyko trial group were taught the Buteyko Method by myself, Tess Graham, a physiotherapist and a trained Buteyko Practitioner. The groups were not made aware of the name of their treatments.

The subjects had clinical assessment involving respirometry testing (Forced Expiratory Volume, Minute Volume, End-Tidal Carbon Dioxide) after a one month run-in period, and at 1 week, 6 weeks and 3 months after the instruction week.

Data from diary cards was gathered at end of run-in, 1 week, 6 weeks, and 3 months. Quality of life questionnaires were administered at run-in, 6 weeks, 3 and 8 months. At eight months a questionnaire seeking details of medication use was administered.

Statistical Analysis

Paired data were compared using paired t-test for normally distributed data, and Willcoxon signed-rank test for non-normal data. For unpaired data, unpaired t-tests and Mann-Whitney-U tests were used for normal and non-normal data respectively. For non-normal data Spearman' Rank was used to investigate correlation. Data are expressed as mean ± SD or median [range]. Statistical significance was defined as $p < 0.05$.

Findings

Subjects

The age distribution, duration of asthma, medication usage, and lung function characteristics of those in each group at the end of the run-in period are shown in Table 1.

Table 1

	Buteyko	**Control**
Age (years)	19	20
Years of asthma	47 ± 17	43 ± 18
Number of Females	9	8
$ß_2$-Agonist use (adjusted)	1288 ± 1039 µg	1029 ± 907 µg
Inhaled Steroid Use	1500 [400 - 4800]	1000 [0 - 3600]
FEV1	78 ± 19%	73 ± 19%
Minute Volume (norm 4 - 6 l/min)	14.0 ± 6.5 l	14.2 ± 4.9l
End Tidal CO2	33.2 ± 4.7 mmHg	32.4 ± 4.1 mmHg
Quality of Life 0 = no impact, 10 = severe	3.0 [0.3 - 7.8]	3.0 [0.2 - 7.0]
Daily Symptom Score	1.6 [0.1 - 2.3]	1.1 [0 - 2.0]

Respiration

The Minute Volume (MV), an objective measure of the volume of air breathed in one minute by a patient at rest and stabilised, is an indicator of the degree of hyperventilation in the patient. The normal Minute Volume of an adult at rest is four to six (4 - 6) litres per minute (Vander et al, 1990; Tobin et al 1983)

At the beginning of the trial all subjects demonstrated hyperventilation. At run-in, the Buteyko group mean MV was 14.0 ± 6.5l and control 14.2 +4.9l (p = 0.9). After three months, the Buteyko group had fallen to 9.6 ± 3.1l; control group mean 13.3 + 4.0l The difference between the two groups at three months was statistically significant with p = 0.004 (see Figure 1).

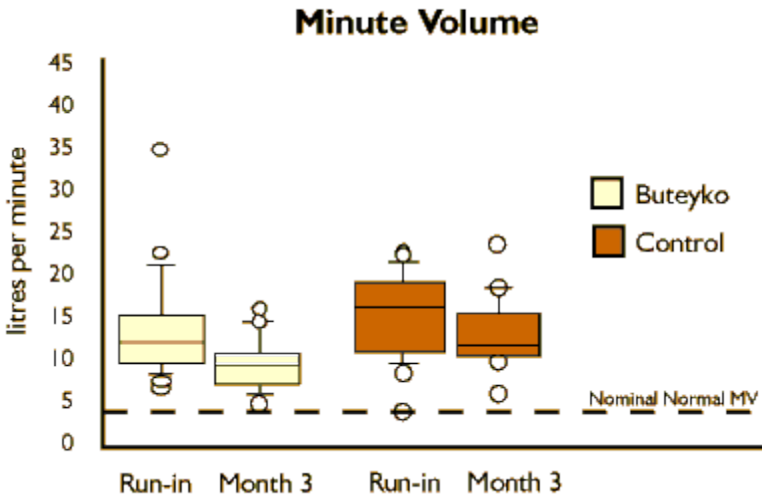

Figure 1: Minute Volume results for Buteyko and control groups. The box contains data from the 25th to the 75th centile; the bar within the box indicates median values. The vertical lines extend to cover 95% of the data - outliers are shown individually. At run-in the Buteyko mean MV was 14 ± 4.9 l and control drop 14 ± 4.9 l (p=0.9). After three months, the Buteyko group had fallen to 9.6 ± 3.1 l; control group mean 13.3 ± 4.0 l (p=0.004). (Modified after Bowler et al, 1995)

Diary Cards Symptom Scores

At 3 months the Buteyko Group showed a greater relative reduction in symptom scores (71%) [100% to - 43%] than did the control group (14%) [100% to -43%] (Bowler et al, 1995), with p = 0.02.

Bronchodilator Usage

At the 6 week, 12 week, and 8 month points the control group had shown a consistent pattern of continuing usage of bronchodilators. After 8 months of study there had been an average increase of daily adjusted $ß_2$ agonist dose (mean + SD) of 288 ± 686ug ; the Buteyko Group maintained significant reduction in bronchodilator usage throughout the study; after 8 months the average reduction for the Buteyko group was 1000 ± 1246ug. The difference between the groups at 8 months was statistically significant with p=0.005 (see Figure 2). Overall, the Buteyko group had up to a 90% average reduction in $ß_2$ agonist usage.

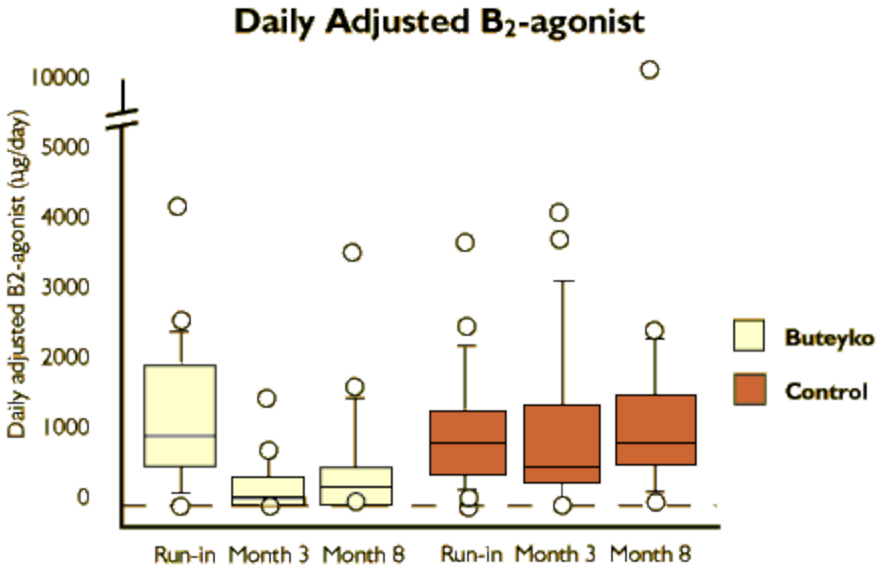

Figure 2: Box plot showing the effect on daily ß$_2$ agonist use. Buteyko and control groups are significantly different from each other at three months and eight months. (Modified after Bowler et al, 1995)

A correlation was found between the relative reduction in use of ß$_2$ agonist in the Buteyko group and the proportionate reduction in Minute Volume, r = 0.51, and p = 0.04.

Steroid Usage

At eight months, compared with run-in, the daily inhaled steroid dose of the Buteyko group had reduced (median [range]) by 26% [-100% to + I 50%], and the control group in dose by 4% [-75% to +400%]. The proportionate reduction in dose is greater for the Buteyko group than for the control group at 8 months, with p = 0.03 (Figure 3).

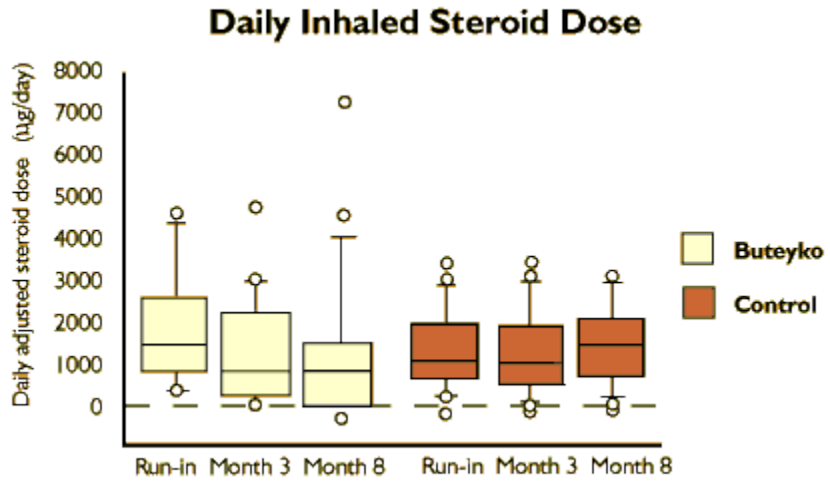

Figure 3: Inhaled steroid usage. The proportionate reduction in dose is greater for the Buteyko group than the control group at 3 months (p = 0.06) and at eight months (p= 0.03). (Modified after Bowler et al, 1995)

Peak Expiratory Flow (PEF) and Forced Expiratory Volume (FEV_1) Measures

No significant changes in these lung functions were noted for either group.

End Tidal CO_2 ($ETCO_2$)

Normal levels for $ETCO_2$ are 40 mm Hg (Anderson Price et al 40mmHg). At run-in, mean $ETCO_2$ for the Buteyko group (mean ± SD) was 33.2 ± 4.7 mm Hg, for the control group, 32.4 ± 4.1 mm Hg. At 5 months the Buteyko group mean was 34.9 ± 2.6 and control 33.3 ± 4.1 mm Hg. There was no significant change in $ETCO_2$ within or between the groups compared with run-in.

Quality of Life

At three months a trend towards greater improvement for the Buteyko group compared to the control group was evident, and this was statistically significant at 8 months, with p 0.04.

Blinding

The Buteyko group was substantially, better than Control group in symptom scores, medication usage, quality of life and Minute Volume before and after unblinding occurred.

Discussion

In this study subjects with asthma showed resting hyperventilation and hypocapnia. The practice of the Buteyko method significantly reduced minute volume and ß$_2$ agonist usage, and resulted in greater relative reduction in symptom scores, and improved aspects of quality of life to a greater extent than did the control group on a conventional breathing program. There was a trend toward greater relative reduction in inhaled steroid usage for the Buteyko group at three months, and this was statistically, significant at eight months. No change in lung functions of FEV_1, and PEF were noted, and no significant increase in $ETCO_2$, was observed in either group.

Excessive medication in any, of the subjects was unlikely to have affected the results, as attempts were made to minimise usage in both groups; also lung function was similarly abnormal in both groups at the end of run-in.

There were some inconsistencies in the data produced by this study.

End tidal CO2

An unexpected finding was the lack of significant increase in $ETCO_2$ for the Buteyko group, even though the Buteyko patients substantially reduced their ventilation (31% reduction at 3 months). The explanation may lie in the lack of rigour in such matters as sequencing of various measurements and the rest period allowed between critical tests. In this study the end-tidal carbon dioxide measurement was reputedly performed after 2 to 3 FEV_1 tests which are forced expiration manoeuvres i.e. hyperventilation. A resultant reduction in CO_2 is likely.

Rest periods of about fifteen minutes are generally required for achievement of the steady state (Askanazi, et al, 1980; Hormbrey et al, 1988). The rest period in the Brisbane study was substantially less. Diffusion characteristics relating to length of illness from asthma and pathological changes at alveolar level may also be relevant.

FEV_1 and Peak Flow

The steroid and symptom reduction achieved by the Buteyko group is an indication that the underlying inflammatory process is likely to have been improved. Despite this, there was a lack of measurable change in the FEV_1, results at the 6 and 12 week points. There could be several reasons for this, chief amongst which are:

(i) the long-term nature of asthma in many, subjects, average 23 years duration, range 3-60 years (see Table 1) may be reflected in the lack of improvement in FEV_1, There are suggestions that long term asthma, and long-term and excess bronchodilator use may adversely affect asthma control and lung function.(Taylor et al., 1993; Selroos et al., 1995)

(ii) The FEV_1 and PEF tests themselves can provoke bronchospasm.

The dynamic manoeuvres of FEV_1 and PEF influence bronchial tone and the airways may collapse by dynamic compression. Those with lack of tone in the airways, floppy airways, are especially affected by the dynamic compression. This is related to years of asthma.

It is known that functional studies of asthmatics that rely on tests involving maximal respiratory manoeuvres such as FEV_1, and PEF, may be biased and ambiguous (Gayrard et al., 1978). Deep inspiratory manoeuvres in asthmatics are known to reduce bronchial patency (ibid).

In Gayrard's study, in all 40 asthmatics studied, deep inspiration produced instantaneous bronchospasm. "PEFR is a crude measure of bronchoconstriction and being effort dependent, cannot alone provide conclusive evidence of asthma.' (Hibbert & Pilsbury, 1988).

(iii) The predefined minimum four hour period since bronchodilator usage was not observed in this study in all cases when the baseline FEV_1, reading was recorded.

(iv) Only six of the thirty nine patients showed improvement in FEV_1, of greater than 15% after bronchodilator usage at the beginning of the trial in November 1994. This relates to (iii) and to potential chronic obstructive airway disease and irreversible airway obstruction of some participants. Buteyko patients had an average age of 48 years. One third of the Buteyko group were aged 64 or over. The control group had an average age of 43 years. The average duration of asthma for both groups was 23 years.

Medication Effectiveness

The control group continued to require the same amount of bronchodilator and steroid drugs over the study period and this usage failed to achieve any improvement in their lung function. As these drugs are given to decrease symptoms, such as constriction and inflammation, this raises an important question. How, did the Buteyko group have fewer symptoms than the control group, despite the control group using four times more bronchodilator medication? These results may suggest that the anti-inflammatory drugs in the control group had lost their effectiveness to further decrease inflammation, as there was no significant reduction in control group symptoms. The Buteyko group significantly reduced symptoms and bronchodilator and inhaled steroid usage without loss of lung function. The 8 month assessment point was in Winter.

Hyperventilation, Dehydration, Bronchospasm, Inflammation, and Allergens

Hyperventilation is known to cause asthmatic episodes (Demeter et al, 1986). Over breathing dehydrates the airways and dehydration can lead to bronchoconstriction, inflammation and mucus production. Over breathing also increases the inhalation of allergens. Deficiency of CO_2 causes a shift in acid/alkali balance to alkalinity, which disturbs immunity. According to Buteyko (1990, cited in Stalmatsky, 1993), this exacerbates allergic reactions and increases viral susceptibility.

Hyperventilation results in hypocapnia which increases both central and peripheral airway resistance in asthmatic subjects (van den Elshout et al, 1991). The reduction of hyperventilation through the Buteyko Method may impact on water loss both directly, and indirectly through the vasodilatory effects of carbon dioxide (Donnelly, 1991), improving bronchial blood flow and therefore rehydrating or maintaining hydration of the airways. Carbon dioxide is a smooth muscle relaxant. The bronchodilatory-effects of CO_2 are well known (Donnelly, 1991; van den Elshout, 1991).

The Brisbane study identified hyperventilation and hypocapnia in all participants initially. Hormberg et al (1988) also found asthmatic subjects had significantly higher minute volumes and lower carbon dioxide than control subjects. By reducing the over breathing, the Buteyko Method appears to treat the cause of these physiological disturbances. Reduced volumes reduce allergen intake, normalise pH and therefore impact on immune function, reduce dehydration and bronchoconstrictive and inflammatory effects. The trial participants also benefited by the technique had reported a range of types of asthma: occupations, atopic/allergic, viral, stress and exercise induced. The demonstrated success of the Buteyko Method with all 'types' of asthma relates to its addressing the pathological condition common to all in this study group, i.e. hyperventilation and hypocapnia.

Relevant Diagnostic Testing

National Asthma Campaign spokesman, Dr Rob Pierce recently said that breathing tests should be as common as blood-pressure tests (Pierce 1996). However, the commonly tested forced volumes (FEV_1 and PEF) are not a measurement of the resting breathing pattern and do not assist in the diagnosis of hyperventilation. The resting pattern, minute volume and $ETCO_2$ need to be measured to diagnose hyperventilation and hypocapnia. Gardner (1990) commented that:

"In my opinion, this disorder (hyperventilation) will only gain recognition by mainline physicians and physiologists "when scientific papers in the field use excessively rigorous criteria for definition and diagnosis. This means that demonstrations of hypocapnia should have a high priority."

Further Research

The fact that the Minute Volume measurement was reduced in the Buteyko Group along with simultaneous significant reduction in the need for bronchodilators supports:

a - the known link between hyperventilation and asthma
b - the efficacy of the Buteyko Method in normalising breathing
c - the relationship between the normalisation of breathing and the reduced need for medication.

The research team has recommended further studies to help in understanding how patients who demonstrably are in control of their asthma did not record better FEV_1 readings. A trend was observed: those with the longest standing asthma (asthma for more than 30 years), are also those who overall showed no improvement in FEV_1. We cannot differentiate it from chance in a study of this size.

The apparent trend which emerges from stratifying the data by length of illness suggests that this could be a productive line of inquiry. Careful consideration should be given to patient selection for subsequent research.

The uncertainties created by the inconclusive and inconsistent results from some of the lung function tests in this study, should be viewed with scepticism unless supported by subsequent research, due to problems associated with lack- of rigour in some of the research methods. Further research is warranted to establish whether such methodological flaws were responsible for some inconclusive outcomes. Stratification of results according to the years of asthma suffered would also be a useful refinement.

It is Buteyko's personal view, that three months is too short a period in which to expect dynamic improvements in the lung pathology of people who have suffered with asthma for up to 60 years. This is supported by studies such as that by Selroos (1995),

Studies into the therapeutic effect of the Buteyko Method on general health are also important since hyperventilation is well known to cause general physiological imbalance (Brown (1953) in Demeter and Cordasco, 1986, and Fried (1990). Buteyko claims that his treatment techniques are effective in the medium term in remedying lung damage, including emphysema (Buteyko, 1990, cited by Stalmatsky, 1993). A study by Tobin et al (1983), showed minute ventilation was increased above that of normal subjects in smokers, and patients with asthma, chronic obstructive pulmonary disease, restrictive lung disease, pulmonary hypertension and chronic anxiety. Brown suggested that "prolonged hyperventilation begets hyperventilation" (Brown (1953) in Demeter and Cordasco, 1986). Buteyko asserts that his method remedies both obvious and hidden hyperventilation with consequent healing.

Conclusions

Although there is some disagreement within the research team over the mechanisms/ physiological processes involved, there is no dispute about the relative effectiveness of the two types of treatment. Those who learned the Buteyko Method experienced a significant improvement in the quality of their lives, and had fewer episodes of asthma. This enabled them to substantially reduce their doses of $ß_2$ agonists and inhaled steroids without loss of lung function, and they were able to sustain this improvement. The control group who followed a conventional medical management and physiotherapy approach showed no improvement in their ability to manage their asthma, nor in quality of life.

These are important findings in the light of recent evidence implicating inhaled bronchodilators in the mortality and increasing morbidity of asthma (Blauw & Westendrop, 1995; Taylor et al, 1993).

The objective evidence available from this clinical trial indicates the need for some modifications of current practice in order to assist people to manage their asthma better.

Specifically these include:-

1. Screening of patients to identify those who are breathing outside the acknowledged normal (adult) range of 4 to 6 litres per minute.

2. Screening for hypocapnia

3. Instruction of such patients in effective ways by which they can normalise their breathing in order to improve their general health and specifically control asthma.

The commonly tested forced volumes are not a measurement of the resting breathing pattern.

The study indicated the need for those involved in diagnosing and caring for people with asthma to respond to the findings from the Brisbane Buteyko trial by reassessing their practice. This includes physiotherapists, health and fitness educators.

Buteyko's theory of the link between asthma and hyperventilation was supported by the finding of hyperventilation and hypocapnia in all participants in the study. The Buteyko Method was shown to be effective in normalising ventilation with a corresponding reduction in frequency of symptoms and need for medication.

To replicate the high efficacy as shown in this study and to ensure appropriate and skilled instruction, it is important that instructors be adequately trained in Buteyko's method and principles. Some breathing techniques used traditionally are often an excellent lesson in how to hyperventilate (Fried, 1990), and many such techniques have not been rigorously evaluated. Recent reviews of published studies show that some are of questionable benefit. Nevertheless, the physiotherapists involved were found to be reluctant to change current practice despite the research findings (Tucker et al, 1996).

There is a misconception that the Buteyko Method is just breathing exercises, and a 'hypoventilation' technique. The Buteyko Method is far more than just breathing exercises. It is a program refined over 44 years of medical research and experience, which manages the complex changes in body chemistry as carbon dioxide levels readjust to normal. The causes of the hyperventilation need to be recognised and addressed. This is why with the Buteyko Method even babies can he successfully treated.

The Buteyko Method is an orthodox treatment since it recognises hyperventilation and hypocapnia and treats them appropriately by normalising breathing.

The desire of patients for autonomy through self-care deserves recognition and support. The Buteyko Method has been shown through medical science and anecdotal evidence to be a very effective and safe self management strategy for asthma.

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