Sleep apnoea and breathing retraining

To what extent is the Buteyko Institute Method of breathing retraining effective for sleep apnoea? A survey of Buteyko Institute practitioners' experiences with clients suffering from sleep apnoea.

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Abstract

This report analyses information from a survey on breathing retraining in relation to sleep apnoea, conducted in 2010 on behalf of the Buteyko Institute of Breathing and Health (BIBH). The aim of the BIBH survey was to determine how effective the Buteyko Institute Method (BIM) of breathing retraining is for clients suffering from sleep apnoea. Information obtained from this survey was based on the experiences of Buteyko Institute practitioners and covered over 11,000 clients with sleep apnoea who had been taught the method.

The majority of practitioners who responded estimated that following BIM breathing retraining courses:

- Over 95 percent of clients with sleep apnoea had improved sleep.
- Approximately 80 percent of clients had been able to cease use of their CPAP machine or oral appliances.
- Symptoms such as snoring, headaches, restless legs, low concentration levels and decreased energy levels also improved in the majority of clients.

In addition, this report analyses the relationship between disordered breathing patterns and sleep apnoea, and suggests that hyperventilation may be a key factor in sleep apnoea aetiology and pathophysiology.

While the outcomes from the BIBH survey are based on anecdotal evidence, the Buteyko Institute considers that the method warrants further study and contends that breathing retraining using the Buteyko Institute Method may offer an effective, safe and acceptable option for people with sleep apnoea.

Buteyko Institute and the Buteyko Institute Method (BIM)

The Buteyko Institute of Breathing and Health is an Australian-based not-for-profit professional organization founded in 1996, which regulates and represents practitioner members in Australia and overseas. Before becoming accredited by the BIBH, practitioners undergo extensive theoretical and practical training and when accredited as practitioner members, are required to practise in accordance with the Buteyko Institute codes and standards.[1] The Buteyko Institute Method of breathing retraining taught by BIBH practitioners is based on the work of Russian physiologist and medical doctor, the late Professor Konstantin Pavlovich Buteyko.

The objective of the BIM method of breathing retraining is to normalize the breathing pattern in every respect. It incorporates client education and breathing retraining exercises which aim to:

- improve the breathing volume, rate, and rhythm
- improve posture and promote correct use of the diaphragm and breathing muscles
- restore comfortable nose-breathing.

BIM courses also incorporate lifestyle changes and provide guidelines and strategies aimed at improving sleep and eliminating symptoms. BIM courses generally consist of five consecutive daily 90 minute sessions and also include follow-up reviews. The breathing retraining exercises are performed regularly on a daily basis until breathing is improved, symptoms are eliminated and normal breathing patterns become automatic.

The Buteyko method was developed in Russia in the 1950s and was endorsed as a mainstream therapy for asthma in the Soviet Union in 1983. Following its introduction to Australia in 1990, the method was taught mainly to people with asthma. However, in the past decade, increasing numbers of people with sleep apnoea in Australia and overseas have attended courses in breathing retraining using the Buteyko Institute Method.

In 2010, in light of the increasing numbers of people with sleep apnoea attending Buteyko courses during the preceding decade and the lack of clinical trials on the topic, the BIBH decided to conduct a survey on sleep apnoea, as a preliminary to possible clinical trials. Throughout their years of experience in teaching the method to people with sleep apnoea, Buteyko Institute practitioners have accumulated a large body of knowledge on this topic. Therefore, this survey was based on the retrospective experiences of Buteyko Institute practitioners who had taught the method to clients with sleep apnoea. The objective of this survey was to determine how effective the Buteyko Institute Method is for people with sleep apnoea from the perspective of BIBH practitioners.

Sleep-disordered breathing

Central sleep apnoea (CSA) and obstructive sleep apnoea (OSA) are considered to be two forms of sleep-disordered breathing (SDB). Obstructive sleep apnoea, the most common form of sleep apnoea,[2] is a condition characterized by repetitive episodes of complete or partial upper airway obstruction during sleep (i.e. apnoea or hypopnoea), producing repetitive episodes of arousal or semi-arousal from sleep and hypoxemia (reduced oxygenation).[3] Central sleep apnoea is characterized by the periodic occurrence of apnoea in association with loss of ventilatory motor output.[4] Sleep medicine has only recently been recognized as a specialty of medicine and the widespread use of polysomnography (sleep studies) to diagnose sleep apnoea is also relatively recent.[5]

Estimates of the number of people suffering from obstructive sleep apnoea vary. An Australian publication by the National Health & Medical Research Council (NHMRC) from 2000, quotes

one source as estimating that 24 percent of males over 55 and 6 percent of females over 55 in Australia suffer from obstructive sleep apnoea.[6]

Research on disordered breathing patterns

From his clinical practice and extensive research, Professor Konstantin Buteyko found that disordered and abnormal breathing patterns were characteristic in people with asthma, sleep disturbance and many other common health conditions. Chronic hyperventilation was the most consistently found overriding breathing pattern disorder. Intermittent hyperventilatory breaths (in the form of sighing, yawning, and gasping for example) were also common, often appearing in addition to a pattern of chronic hyperventilation. Hyperventilation can be defined as:

> *"A pulmonary ventilation rate that is greater than metabolically necessary for the exchange of respiratory gases. It is a result of an increased frequency of breathing, an increased tidal volume or a combination of both, and causes an excessive intake of oxygen and the blowing off of carbon dioxide."* [7]

Professor Buteyko found that hyperventilation caused or contributed to several conditions, including asthma and "sleep disturbance".[8] Professor Buteyko's clinical research was conducted in the Soviet Union from the 1950s to the 1980s (before sleep medicine became widespread as a medical specialty) and some of his work has not yet been translated from Russian. A chapter of a book relating to Professor Buteyko' work (*The Buteyko Book, translated from Russian*) refers to a study of people with "sleep disturbance". Forty-one people were listed as suffering from sleep disturbance. Following breathing retraining, in 26 the condition is noted to have disappeared, in 13 it decreased and in two no change is reported.[9]

The first clinical trial of the Buteyko method in the Western World was conducted in Australia and published in the *Medical Journal of Australia* in 1998. This blinded randomised controlled trial showed that the asthma patients studied were significantly hyperventilating. At the start of the trial, the average minute volume was 14 litres per minute compared with the normal range of four to six litres per minute. Three months following a Buteyko course, minute volume in the Buteyko group was reduced to 9.6 litres per minute, and this reduction correlated with a significant reduction in the need for asthma medication.[10] A subsequent Australian study in 2004 found that end-tidal carbon dioxide ($ETCO_2$) in asthma patients increased as a result of the Buteyko method[11] suggesting that hyperventilation had decreased as a result of breathing retraining using the method.

Professor Buteyko's findings on hyperventilation in association with numerous symptoms and conditions are supported by the work of expert clinicians. Buteyko found that hyperventilation was not always apparent – either to the patient or to the doctor – and hence he called the condition "hidden hyperventilation". Respiratory physician and pioneer on hyperventilation, the late Dr Claude Lum, also maintained that hyperventilation was not always evident and in fact, he referred to classic or obvious hyperventilation as "…the tip of the iceberg", occurring in only one percent of cases.[12] World-renowned psychologist, Professor Robert Fried,[13] also describes the effects of hyperventilation and associated illnesses and conditions.

Sleep apnoea – aetiology and pathophysiology

Despite extensive clinical research within the past thirty years, the aetiology of sleep apnoea is unknown. Considerable research has focused on the possible causes of sleep apnoea, including altered sleep architecture, obesity, and underlying anatomical and physiological anomalies that might be linked to apnoea. Experts acknowledge that the pathophysiology of sleep apnoea is complex and there may be considerable variations in contributing factors. For

example, reduced upper airway dimensions and altered tissue mechanics are considered to play a part but do not suffice to explain the upper airway collapse which occurs during OSA, according to Gaudette and Kimoff published in the *European Respiratory Society Monograph* in 2010.[14]

Proponents of the breathing retraining approach to the management of sleep apnoea contend that as sleep apnoea is characterised as sleep-disordered breathing, its aetiology is more likely to be found in association with abnormal or disordered breathing patterns, specifically those associated with intermittent or chronic hyperventilation. Signs and symptoms of breathing pattern disorder which may be indicative of chronic or intermittent hyperventilation in association with sleep apnoea include:

- mouth-breathing
- audible breathing
- feeling short of breath or unable to get enough air
- large chest excursion
- irregular or erratic breathing patterns
- elevated respiratory rate*
- increased tidal volume*
- increased minute volume when not in apnoea or hypopnoea*
- decreased end-tidal carbon dioxide levels when not in apnoea or hypopnoea
- upper chest breathing pattern
- a daytime breathing pattern characterised by uneven-sized breaths, apnoea, and frequent yawning and sighing
- a night-time breathing pattern characterised by uneven-sized breaths, apnoea, hypopnoea, gasping, snoring and snorting.

**An elevated respiratory airflow rate occurs in conjunction with these signs of hyperventilation*

Hyperventilation as a contributory or causal mechanism in sleep apnoea

There are several mechanisms by which hyperventilation may cause or contribute to the signs and symptoms seen in association with sleep apnoea. As mentioned earlier, hyperventilation causes excessive exhalation of carbon dioxide (CO_2), which leads to hypocapnia. In hypocapnia, less oxygen splits from haemoglobin due to the Bohr effect or oxygen-haemoglobin dissociation curve, which is documented in the medical literature.[15] It is argued therefore, that hypoxia in sleep apnoea may be a consequence of transient or chronic hyperventilation, reduced CO_2 levels when not in apnoea/hypopnoea, and recurring apnoea and/or hypopnoea.

Several studies suggest an association between hyperventilation, decreased carbon dioxide levels and apnoea. A study by Radwan in 1995 found minute volumes of 15 L per minute in people with obstructive sleep apnoea when awake (normal range 4 – 6 L/min.).[16] Research conducted by Meah and Gardner in 1994 shows either apnoea or hypopnoea following voluntary over-breathing in conscious humans.[17]

Also, two basic principles of fluid flow, the Bernoulli principle and the Venturi effect, can be applied to give additional insight into airway narrowing. Medscape writer, Veena Sankar MD, describing physiologic approaches to snoring and sleep apnoea states:

> *"The Bernoulli principle describes fluid flow in a column. A partial vacuum exists at the outer edges of a column of moving fluid. As airflow speed increases, the partial vacuum*

pressure increases. The smaller the column is, the faster the flow. This principle is illustrated by a drinking straw: If too much negative pressure is generated within the straw, it collapses; as the negative pressure decreases, the straw becomes more rigid and does not collapse.

The Venturi effect describes the acceleration of airflow that occurs as a current of air enters a narrow passageway. The wind blowing between buildings or the water spraying out of a hose that is partially occluded by the thumb are examples of this effect. In the human anatomy, the pharynx is the passageway, and the distensibility and movable walls of the pharynx govern the width of the named passageway; thus, inhaled air accelerates through the pharynx."[18]

Writers such as Downey agree that the Bernoulli effect can play an important dynamic role in OSA pathophysiology. "In accordance with this effect, airflow velocity increases at the site of stricture in the airway. As airway velocity increases, pressure on the lateral wall decreases. If the transmural closing pressure is reached, the airway collapses," Downey states.[19] The Bernoulli effect is exaggerated in areas where the airway is most compliant. Loads on the pharyngeal walls increase adherence and, hence, increase the likelihood of collapse.

In view of these physiological principles, it is suggested by proponents of breathing retraining that hyperventilation – an elevated breathing rate and/or volume, in conjunction with an elevated inspiratory airflow rate – may be a causal or contributory factor in OSA. .

Several studies appear to support the hyperventilation hypothesis in regard to sleep apnoea. Numerous clinical studies have demonstrated that inhalation of supplemental CO_2 has been shown to reduce apnoeas in OSA. A study by Hudgel et al in 1988 found that inhalation of 3 to 6% CO_2 changed the oxygen-carbon dioxide concentrations and significantly decreased apnoeas in OSA.[20] In a later study, Hudgel concluded that "By stimulating upper airway inspiratory muscles, CO_2 eliminates the hypoapneic, low-drive, high-resistance periods and thereby reduces the number of apneas."[21]

In 2001, Xie et al suggested that hypoxia causes periodic breathing during sleep that can be prevented or eliminated with supplemental CO_2.[22] A study by Thomas et al in 2005 also found that people with severe sleep apnoea improved when given supplemental carbon dioxide. Thomas et al concluded: "Low concentrations of carbon dioxide added to conventional positive airway pressure effectively control severe treatment-resistant mixed obstructive and central sleep-disordered breathing."[23] Collectively, all of these clinical studies strongly suggest an association between hyperventilation, hypocapnia and sleep apnoea.

Minute volume, tidal volume, inspiratory airflow rate and end-tidal CO_2 levels are generally not measured in polysomnography studies. It is significant to note, however, that in the main, sleep studies suggest that the majority of apnoeas and/or hypopnoeas occur when the person is in the supine position and is therefore, more likely to be mouth-breathing, and consequently more likely to be hyperventilating. Further, there is evidence to suggest that mouth-breathing increases upper airway collapsibility during sleep[24] and that the use of a chin strap to keep the mouth closed during sleep reduces the incidence of sleep apnoea.[25]

Proposed mechanisms using breathing retraining to alleviate sleep apnoea

Following breathing retraining, independent clinical trials of the Buteyko method for people suffering from asthma have shown:

1. Decreased baseline (resting) minute volume[26]
2. Increased baseline CO_2 levels.[27] [28]

These findings suggest a reduction in hyperventilation following Buteyko courses for people with asthma, a phenomenon which breathing retraining proponents contend could also have significant implications for people with sleep apnoea. Proponents of breathing retraining contend that the Buteyko Institute Method of breathing retraining can reduce hyperventilation, thereby reducing inspiratory airflow rate, tidal volume and airway vibration and turbulence (snoring). Excessive negative inspiratory pressures can be reduced, preventing upper airway collapse and obstruction. Reduction of hyperventilation leads to improvement in tissue oxygenation and homeostasis through stabilisation and normalisation of blood gases via the Bohr effect and stabilisation of the central control of breathing.

BIBH 2010 sleep apnoea survey

The 2010 BIBH study was a retrospective survey based on an existing pool of knowledge among BIBH practitioner members. In August 2010, a questionnaire was distributed to all Buteyko Institute members via a group email which is only available to current Buteyko Institute members. This questionnaire comprised six pages of questions, and practitioners were asked to complete their responses to 24 questions mainly by ticking boxes, and were also requested to comment as necessary. Questions were developed with the objective of eliciting as much information as possible on the subject, and discovering the outcomes and benefits of the methods for sleep apnoea sufferers, as well as finding out some of the challenges and issues arising in teaching the method to people with sleep apnoea.

As the two forms of sleep apnoea (OSA and CSA) are sometimes seen in combination or "mixed", and the BIM is taught to clients with both types of sleep apnoea, the BIBH survey did not differentiate between CSA and OSA and the survey questionnaire referred only to "sleep apnoea".

Confidentially was maintained at all times and information provided was not shared with any individual or group. All completed questionnaires were sent directly to the researcher.[29] Responses were coded to remove identifying information before collation and analyses of information provided. Analyses were conducted manually and using Microsoft Excel.

Literature review

A search of the major online databases, including the Cochrane Library, PubMed, MEDLINE, and www.controlled-trials.com, revealed no previous clinical trials related to the Buteyko Method or other forms of breathing retraining in association with sleep apnoea. Numerous clinical studies related to disordered breathing patterns in association with sleep apnoea were found. Several independent clinical trials of the Buteyko method were found which showed significant improvements for people with asthma.[30] [31] [32] [33]

Survey sample

In total, fifteen BIBH practitioner members returned completed questionnaires. The majority of responses came from Australia (67%) with other responses coming from the UK, USA, New Zealand, and Canada. The majority of respondents (67%) stated they had been in practice as Buteyko practitioners for over ten years. Three respondents had been in practice for five to eight

years, one respondent for between eight and ten years and one respondent for less than five years.

Total number of sleep apnoea clients taught by respondents
The total estimated number of clients with sleep apnoea taught by the combined total of respondents from the start of their practice was approximately 11,330 as shown in Figure 1.

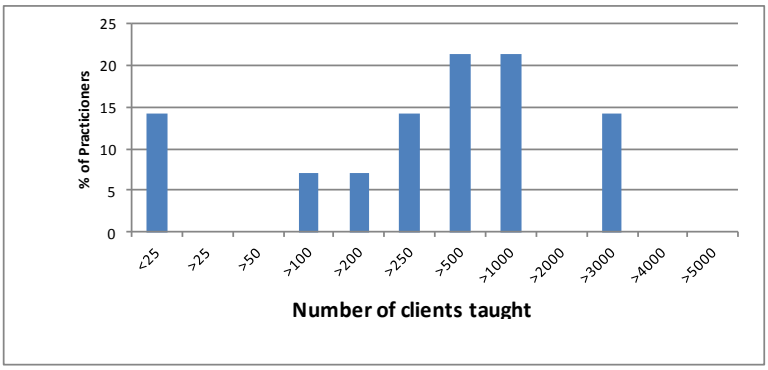

Figure 1: Total no. of sleep apnoea clients taught by survey respondents

The majority of the survey respondents estimated that most of their clients with sleep apnoea were in the age range 50 to 69 years. In addition, the majority of respondents reported a significant increase in clients with sleep apnoea attending Buteyko Institute courses in the three years prior to the survey. One out of four practitioners estimated that over half of their clients in the past three years had suffered from sleep apnoea. Further, almost half of the respondents estimated that clients with sleep apnoea had formed between 30 and 40 percent of their total clientele in the three years prior to the study.

Sleep apnoea diagnoses
Respondents estimated that the majority of clients with sleep apnoea who enrolled in courses were diagnosed by a sleep study (80%) while a further seven percent were diagnosed by a physician or General Practitioner. Respondents also estimated that approximately seven percent of clients were diagnosed by themselves and/or a partner. For a further seven percent of clients, respondents indicated that it was not known how they were diagnosed.

BIM survey questionnaire
In order to determine how effective the BIM of breathing retraining is, the survey questionnaire requested practitioners to estimate outcomes from their practice across several domains for clients with sleep apnoea who had already completed courses. These domains included:

- Sleep improved
- Energy levels improved
- Health improved
- Concentration improved
- Ceased use of CPAP machine (for clients on CPAP)
- Ceased use of oral appliances (for those using dental splints)
- Stopped or decreased snoring (for clients with this symptom)
- Headaches decreased (for clients with this symptom)
- Periodic limb movements/restless legs decreased (for clients with these symptoms)
- Achieved weight loss (if overweight)

- Found the help they needed although previously unsure of outcomes (where applicable)
- Some benefits achieved but not entirely satisfied
- No benefits achieved
- Other? Please specify

Improvements in sleep, health, concentration and energy levels

Practitioners who responded estimated substantial improvement over several domains following BIM courses. Three out of every four practitioners estimated that >95 percent of clients with sleep apnoea had improved sleep, while one in four practitioners estimated that 80 to 95 percent of their clients had improved sleep.

Energy levels and concentration levels improved in > 80 percent of clients, according to the majority of responses. Health also improved in the majority of people who had attended courses, according to the estimates.

Ceasing use of CPAP machines and oral appliances are major objectives for some clients attending BIM courses. Approximately half of the practitioners surveyed estimated that > 80 percent of their clients were able to cease use of their CPAP machine during the course and follow-up period. One in four practitioners estimated that 60 to 80 percent of clients were able to cease use of their CPAP machine. In addition, the majority of practitioners estimated that over 80 percent of clients had been able to cease using oral appliances such as mandibular advancement splints following breathing retraining courses.

Improvements in snoring, headaches, period limb movements, obesity

Snoring is also one of the major symptoms commonly associated with sleep apnoea and impacts not only on the person who snores but also on their partner. Loud snoring can prevent the partner from falling asleep or may wake them up several times a night. It can wake or half-waken the snorer and can thus affect the quality of sleep achieved. Therefore, decreasing or stopping snoring is a major objective for many course participants, regardless of whether they use CPAP machines or oral appliances. Over 80 per cent of course attendees managed to stop snoring, according to estimations from 60 percent of practitioners. A further one in four practitioners estimated a success rate of 60 to 80 percent in stopping snoring.

Headaches are also commonly associated with sleep problems such as snoring and sleep apnoea. The estimates show that headaches improved for over 80 percent of clients according to the majority of practitioners who responded. A further domain, periodic limb movements/restless legs which are sometimes associated with sleep apnoea, were also found to be improved by BIM breathing retraining courses. One-third of practitioners estimated that over 80 percent of clients suffering from restless legs managed to improve this symptom following their courses, while a further 40 percent of practitioners estimated that for 40 to 80 percent of clients this symptom improved.

Obesity is generally considered to be a major contributing factor in OSA. Whether obesity is worsened by a lack of refreshing sleep or whether changes in metabolism caused by OSA are associated with imbalances in the hormones leptin and ghrelin, have been the subject of research published in the sleep specialty literature. In addition, the effects of hypoxia on metabolism have been the subject of considerable research in recent years. Recent research suggests that obesity and OSA form a vicious cycle where each results in worsening of the other.[34] Other research which may support this theory has found that hypoxia (a major

characteristic of apnoea and hypopnoea) suppresses resting energy expenditure thus leading to obesity.[35]

Estimates from respondents on the issue of weight loss are varied. Courses generally run for five consecutive days followed by a follow-up review two weeks later and thus one would not expect to see major reductions in weight in this time span. Approximately one in three practitioners estimated that weight loss occurred in 20 to 60 percent of overweight clients.

Client assessment and monitoring

Clients who attend BIM breathing retraining courses are assessed before, during and following courses, in line with Buteyko Institute recommendations. A majority of respondents indicated that they concurrently use eight different means of assessment for each client (see figure 2). Most practitioners use methods such as pulse rate, breathing rate, locus of breathing (chest/diaphragm), mode of breathing (nose/mouth), breath-holding test (a measure of cardiopulmonary reserve), progress notes on sleep/health and clients' diary sheets for each client with sleep apnoea. In addition, over 60 percent of practitioners who responded indicated that rating symptoms on a questionnaire was also used.

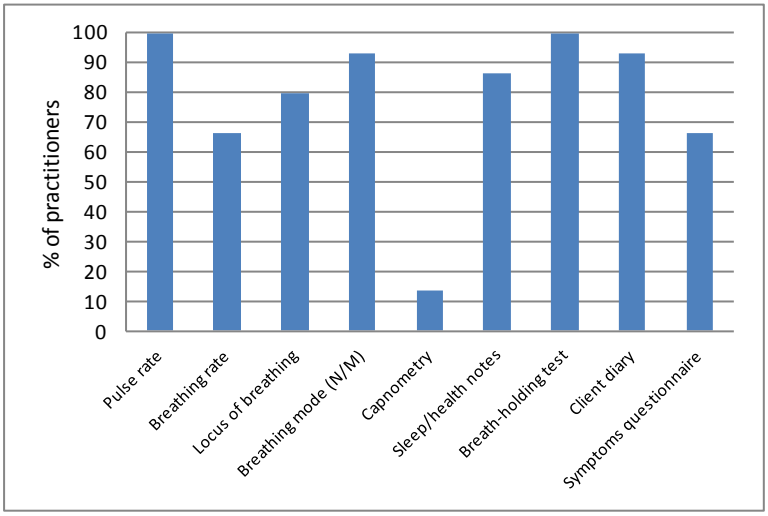

Figure 2: Client assessments methods used by survey respondents

In addition to the assessment methods shown in Figure 2, some practitioners said they use communication such as:

- *Ascertaining clients' satisfaction and understanding*
- *Asking partner*
- *Discussing progress with clients as the course progresses and after the course.*

One practitioner said he/she used pulse oximetry (a measure of haemoglobin oxygen saturation) as an additional assessment tool. Two of the 15 respondents indicated that they used capnometry as an assessment tool to measure end-tidal carbon dioxide ($ETCO_2$) levels. Reduced $ETCO_2$ levels can indicate hyperventilation. Comments on client assessment and monitoring included:

"The newer models of CPAP may prove a useful assessment tool for obstructive sleep apnoea clients. If clients use a self-regulating CPAP (i.e. VPAP) they will be able to see from computer print outs when their obstructive sleep apnoea has improved because the machine will not be activated as often. This is one way of being safely able to demonstrate that the BIM is working."

"Some CPAP models show that the average pressure reached during the night is lower following a breathing retraining course".

Unexpected benefits arising from BIM courses

Practitioners were asked to comment on unexpected benefits arising from courses. Numerous comments were received and can be summarised to include:

- clients were able to resume hobbies and activities
- clients were able to resume work after retiring with ill health
- clients had increased exercise capacity
- clients experienced improvements in relationships
- sleep improved for clients *and* their partners

Sleep studies showing before and after BIM breathing retraining

The Buteyko Institute recommends that clients undergo sleep studies following breathing retraining courses. The following summaries are taken from sleep studies forwarded by Buteyko Institute Practitioners with their clients' permission, as part of the 2010 BIBH survey. All identifying information has been removed to ensure confidentiality.

Client A

	Gender Age	BMI	AHI	O_2 Desat. Index per hour	Event count		Analysed Interval: Duration
Before BIM course Sept 2009	Male Aged 66	28.6	60.5 High	40.4 High	Apnoeas: 204	Hypopnoeas 109	326 minutes
Sept 2009 – Respiratory & Sleep Physician's comments: "… study confirmed severe obstructive sleep apnoea…"							
After BIM June 2010 Level IV Oximetry Study	67	27	Not done	6.1	Not done	Not done	Not provided
June 2010 – Respiratory & General Physician's comments: "…he has followed a program of Buteyko breathing… there seems to be a strong suggestion that his symptoms have improved considerably." ***August 2010 – From client's written comments to Buteyko Practitioner: client tried unsuccessfully to get a repeat sleep study done. However, a Level IV Oximetry study (measuring oxygen desaturation) was done instead.***							

Client B

	Gender Age	BMI	AHI	O_2 Desaturation	Event count		Sleep Duration
Before BIM course Sept 2008	Male 56	28.7	40	Baseline 95% to Minimum 83%	189 apnoeas	103 hypopnoeas	7 hours, 18 minutes
Aug 2008 Summary: "Snoring recorded for 42% of sleep time. The study indicates SEVERE OSA."							
After BIM Aug 2009	57	28	6	No events of O_2 desat. from 96% baseline	13 apnoea	22 hypopnoeas	5 hours, 42.5 minutes
Aug 2009 Summary: "Snoring recorded for 29% of sleep time. The study indicates snoring only"							

Client C

	Gender Age	BMI	AHI	O_2 Desaturation	Desaturation Events/hr		Sleep Duration
Before BIM course June 2009	Female 54	24.3	AHI Total: 21.6 NREM 10.8/hr REM 68.4/hr	SpO_2 baseline: 98% SpO_2 nadir: NREM 89% REM 80%	REM: Obstructive apnoeas: 60 per hour	NREM: Hypopnoea 8.4 per hour	REM 57 minutes NREM 249 minutes
June 2009 – Sleep Physician's Report: "Conclusion: R.E.M. based severe obstructive sleep apnoea…"							
After BIM course April 2010	55	24	AHI Total: 2.1 Average Supine: 2.9 Average Lateral: O.7	Nadir: NREM 88% REM 93%	REM: Obstructive apnoeas: 0 per hour Hypopnoea: 4 per hour	NREM: Obstruct. apnoeas: 0 per hour Hypopnoea 3.9 per hr	REM 49, NREM 180 minutes
April 2010 – Sleep laboratory physician's comments: "Respiration within normal limits; no evidence of sleep-disordered breathing."							

Client D							
	Gender Age	**BMI**	**AHI**	**O_2 Desaturation**	**Event count**		**Sleep Duration**
Before BIM course Dec 2004	Male 52	24	27.5	Baseline: 95% 166 events. Min. O_2 desat. 69%	119 obstructive apnoeas	13 central apnoeas 4 mixed	6 hours, 17 minutes
Dec 2004 Summary: "Snoring recorded for 66.6% of sleep time. The study indicates MODERATE OSA."							
After BIM Aug 2009	57	23.1	4	Baseline 96% Min. O_2 desat. 91%	4 apnoea 16 hypop-noea	-	4 hours, 47 minutes
Aug 2009 Summary: "Snoring recorded for 23% of sleep time. The study indicates: NO OSA."							

Challenges in teaching BIM

While estimates received from practitioners suggest significant improvement for the majority of clients attending courses, it is apparent that breathing retraining is not a "quick-fix" or a panacea for all people with sleep apnoea. A small minority of clients achieved some benefit only, or was not entirely satisfied. Less than five percent of clients did not achieve the results they wanted, according to the survey. According to the practitioners' comments received, people who did not achieve the desired outcome did not have the time or the motivation to continue with the breathing retraining exercises and ceased performing the exercises too soon, despite encouragement from practitioners.

According to the several practitioners' comments received, teaching the Buteyko Institute Method to clients with sleep apnoea can be very challenging. Clients are generally fatigued, lacking in concentration and alertness and deprived of refreshing sleep. Nevertheless, the greatest challenge according to the majority of respondents is scepticism on the part of clients and their doctors and specialists, largely due to a lack of clinical trials on the method. As one practitioner commented:

> *"The majority of people that we see have been through the traditional medical mill and are often very sceptical – particularly when they see that what we have to offer is so simple in construction. The way that they respond to the outcome and their unqualified support for what we are doing is well worth the time and effort expended. They become ambassadors for the cause."*

Non-adherence/Non-compliance with current therapies

Sleep apnoea is associated with numerous clinical co-morbidities such as hypertension, and vascular and cardiovascular disease.[36] It is also associated with an increase in road accidents due to daytime sleepiness. Therefore, this condition is viewed very seriously by Buteyko Institute practitioners. Despite its prevalence and co-morbidities, treatment options for people suffering from sleep apnoea are limited. In line with BIBH recommendations, course participants are requested not to cease or alter CPAP use (the recommended treatment for moderate to severe OSA) or oral appliances (generally used for mild to moderate OSA) without consulting with their doctor and/or dentist or specialist. However, the BIBH practitioners

surveyed stated that some of their course participants had ceased using or had had not commenced using the prescribed CPAP or oral appliance prior to courses. Others used their CPAP intermittently; while some clients had chosen not to rent or buy the prescribed CPAP.

Information obtained from the BIBH survey suggests that prescribed therapies such as CPAP machines and oral appliances (mandibular advancement devices) were not considered appealing or acceptable options or were not well tolerated by many people. The challenges inherent in optimizing use of CPAP are well documented in the sleep medicine literature.[37] Estimates of non-adherence or non-use of nasal Continuous Positive Airway Pressure (nCPAP) for sleep apnoea may be greater than 50 percent according to an Australian report by the National Health and Medical Research Council which states:

> *About one-third of patients considered for nCPAP treatment did not receive the treatment. Of the two thirds who did, approximately three-quarters (72 percent) continued with the treatment over a longer time frame (more than one month). Thus a little less than half (46.2 percent) of the initial group of patients considered for nCPAP used the treatment for more than one month.*[38]

These figures are supported by a recent meta-analysis in the USA which cites CPAP adherence rates ranging from 30 to 60%.[39] For some studies, regular use of CPAP was defined as low as "4 hours use on 70% of days".[40]

Practitioners were asked to provide reasons why course participants with sleep apnoea had chosen not to commence using or had ceased using the prescribed CPAP prior to courses. From the information provided it was difficult to elicit one overriding reason why this had occurred. In line with studies on non-compliance in the medical literature, there was generally a combination of reasons. Responses suggested that the majority of clients who had discontinued use of their CPAP either could not tolerate the CPAP and/or did not like the CPAP. In addition, large numbers of clients and/or their partners found the CPAP noisy and intrusive. Cost did not appear to be a major factor in relation to non-adherence with the use of CPAP or oral appliances according to survey responses. Responses estimated that only a small number of clients thought the CPAP and oral appliances were too expensive.

Some practitioners commented that clients found the idea of using a CPAP for life intolerable. One practitioner summarised:

> *"I would say that 75% of people who stop using CPAP before they start our courses is because of some version of above 3 points* [Noisy and intrusive/could not tolerate/did not like the CPAP]*. The main complaint is that it is too invasive 'I couldn't bear the thought of it." or "I lay awake for half the night and just couldn't tolerate it', 'I have worse sleep with the machine than I did without it.' After teaching these people for a couple of days and gaining their confidence, you find that they freely admit to feeling threatened or panicked by the mask, and so I think that claustrophobia plays a big role with this.*
>
> *Probably 10% find it uncomfortable: 'I couldn't find a mask to fit my face, shoots air in my eyes, hisses, have to sleep on my back and I can't roll over because it dislodges the mask / too much 'stuff' on my face (straps, mask were too much for them to bear), the air pressure was too strong'.*

Another 10% find they develop sinus / nasal problems because the air irritates their upper airways: 'It dried out my nose, gave me sinus, I never had trouble with my nose until I started using the mask'.

5% found the look of CPAP unattractive. These people are generally single people and don't fancy the idea of their boyfriend / girlfriend seeing them asleep with all of this gear on their face. Or they have red marks on their face for hours after they get up in the morning."

According to a 2006 review of patient compliance and efficacy of oral appliances, treatment adherence varied, with a median appliance use of 77 percent of nights at one year. However, side effects were found to be common but generally "minor" and included excessive salivation, muscle and tooth discomfort and occasionally joint discomfort. These side effects generally improved over time, the review stated.[41] The BIBH practitioners surveyed were asked to provide reasons for discontinuation of prescribed oral appliances (or dental splints) prior to Buteyko courses. The reasons for discontinuation were numerous and included TMJ (temporomandibular joint) pain, damage to teeth, inability to tolerate the splints and/or did not like the splints. Also, some clients found that the oral appliances were not effective.

Study Limitations

The 2010 BIBH survey has limitations, in that the sample is small, respondents were self-selected and the information provided is anecdotal and based on estimates. However, data from the sleep studies shown above were extracted from copies of the original studies submitted to the researcher.

Conclusions

Sleep apnoea is characterised in the medical literature as "sleep-disordered breathing". Although conditions such as obesity and anatomical changes within the upper airway have been identified as potential contributing factors for some people with sleep apnoea, the underlying aetiology and pathophysiology of sleep apnoea is unknown. Given the results of the 2010 BIBH survey on sleep apnoea, the Buteyko Institute contends that the relationship between disordered breathing patterns, hyperventilation and sleep apnoea warrants further study and that the role of breathing retraining using the Buteyko Institute Method for sleep apnoea needs to be scientifically evaluated.

For the following reasons, the Buteyko Institute of Breathing and Health considers that clinical trials of the Buteyko Institute Method of breathing retraining for people with sleep apnoea need to be conducted as soon as possible:

1. Based on over 11,000 clients, estimates from the 2010 BIBH survey suggest that breathing retraining using the BIM show significant improvement in sleep for >95 percent of clients with sleep apnoea who undertook BIM courses.
2. Estimates from the 2010 survey also suggest that approximately 80 percent of clients were able to cease using their CPAP machine.
3. Sleep medicine research suggests that breathing pattern disorder, i.e. intermittent or chronic hyperventilation, is common in people with sleep apnoea.
4. Independent clinical trials in the medical literature indicate that the Buteyko method of breathing retraining is successful in improving disordered breathing patterns and reducing hyperventilation.

5. Although not explored in association with breathing retraining, research in the medical literature appears to support the Buteyko hypothesis on sleep apnoea.
6. Increasing numbers of people are currently being diagnosed with sleep apnoea and increasing numbers of people with sleep apnoea are attending Buteyko Institute courses. Therefore it is necessary to ascertain scientifically how effective the BIM is for sleep apnoea.
7. Currently, limited treatment options are available for many people with sleep apnoea. If validated scientifically, the Buteyko Institute method of breathing retraining would provide a further treatment option for people who cannot tolerate CPAP or oral appliances.
8. Sleep apnoea is a condition with serious co-morbidities, therefore further effective treatment options are urgently required, in light of significant non-adherence with currently available treatments.
9. Compared with existing treatments for sleep apnoea, the cost of the Buteyko Institute Method of breathing retraining is very economical. Buteyko Institute Method of breathing retraining course fees are estimated at approximately 25 percent of the cost of CPAP or oral appliances. In addition, there are no ongoing expenses in relation to the upkeep and maintenance of equipment or appliances.
10. The BIBH 2010 survey suggests that people suffering from sleep apnoea are likely to comply with Buteyko Institute Method of breathing retraining because this method of breathing retraining:
    a. is effective
    b. is safe and non-invasive
    c. does not have side effects
    d. is convenient in comparison with current treatment options
    e. is economical in comparison with current treatment options
    f. is an acceptable and appealing option compared with current treatment options
    g. does not involve the use of equipment or devices
    h. does not involve ongoing maintenance or upgrading of equipment.

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Endnotes

[1] For further information on the Buteyko Institute, the Code of Conduct and other policies and standards, see: www.buteyko.info

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