The Oxygen Advantage

Patrick McKeown

Intro: The Basic Idea

Patrick McKeown tells the story about how he had asthma for many years. His life changed when he came across the work of a Russian physician named Konstantin Buteyko. Using Buteyko's ideas, he cleared up his asthma and went on to study with Dr. Buteyko.

Much of this book is built around one basic principle. Oxygen is carried on hemoglobin after having been picked up in the lungs. The amount of oxygen in the blood is known as *oxygen saturation*, easily measured with a pulse oximeter. What is not generally known is that *for the oxygen to be released from the hemoglobin*, *there must be enough carbon dioxide (CO_2) present.*

If CO_2 is in short supply from over-breathing, oxygen will not be released as readily. This is known as the Bohr Effect, named after Christian Bohr, an early 20^{th} century physiologist who discovered that there must be adequate levels of CO_2 for oxygen to be released from the hemoglobin. This piece is critical to understanding the principles in this book.

The Effects of Low Carbon Dioxide

Hypocapnia is a term used when there is not enough CO_2. Overbreathing over time will make CO_2 receptors in the brain regulatory centers overly-sensitive to increased levels of CO_2 such that *normal levels* are met with a sense of air hunger and a feeling of breathlessness. Excessive sighing and feeling short-of-breath are often signs of a problem with low CO_2.

CO_2 helps offload oxygen into the tissues that need it, helps increase dilation of smooth muscles in the walls of airways and blood vessels, and helps regulate pH. Excess breathing decreases blood vessel diameter by 50%, with blood flow decreasing by a factor of 4.

You may see a state of exhaustion in people who talk a lot. They essentially blow off too much CO_2 and end up tired from a lack of offloading of oxygen in the tissues.

What Is Needed

What McKeown is saying is that we need much greater tolerance for increased levels of CO_2. With over-sensitized CO_2 receptors, you will have an early, increased desire to breathe when CO_2 increases to normal levels. This creates a classic vicious cycle where you overbreathe, losing more carbon dioxide. Over time, this creates a lack of tolerance for normal CO_2 levels in the blood.

How To Test Yourself

McKeown describes what he calls the Body Oxygen Level Test, or B.O.L.T. test. This test is best done first thing in the morning. In this test, you take a normal breath in and out. At the end of the outbreath, breathe in just a bit, then simply hold your breath. You may pinch your nose if that helps. **You measure the time in seconds that it takes before the first physical impulse to breathe comes.** You are not trying to hold your breath a long time here. You are just noting when you get to that first *strong* impulse to breathe.

A common starting place for people with issues here is around 20 seconds. Under 20 seconds, you have a problem. The aim of his program is to get you close to 40 seconds. The closer you are to 40 seconds, the closer you are to having adequate CO_2 levels. To increase your seconds in the B.O.L.T. test, you need to do certain exercises. It can take many weeks to increase B.O.L.T.

With a history of vegetarianism, anemia, women of menstrual age, etc., low iron might be a factor in a low B.O.L.T. score.

What Does “Good” Breathing Look Like?

It is very important to *breathe only through your nose*. Mouth breathing is very damaging to the body if done a lot. He describes taping the lips closed at night with a 3M paper tape called Nexcare First Aid 3M Gentle Paper Tape. You do this with a 1 inch long piece of tape placed on the upper and lower lip. Sounds weird, but it works. For people who can’t stand that idea, you can find a stop snoring strap at oxygenadvantage.com Wearing the tape or the strap for three months is usually sufficient to retrain your body to breathe with your mouth closed at night.

Stressed breathing is faster than normal, audible, produces visible movement, and involves sighs. With stressed breathing there is less oxygen release in the brain, making it hard to think clearly. Breathing when relaxed is abdominal, slow, gentle, calm, regular, relatively unnoticeable, silent, and through the nose.

In TaiChi and QiGong tournaments, points are deducted if breathing is noticed by the judges.

McKeown mentions three levels of less-is-more: 1) The person next to you doesn't hear you breathing 2) You do not hear yourself breathing 3) You do not feel yourself breathing.

The work of a man named Tom Piszkin is described. He learned that if you cannot sustain your exercise while breathing only through your nose, you are going too hard or too fast. He used tape to keep his mouth closed during workouts. This was in 1974. Over time, his fitness improved remarkably by exerting with his mouth closed.

Most athletes breathe through their mouth. "Western habits have become so far removed from what they should be that mouth breathing has become the norm."

Breathing through the nose: 1) Warms and humidifies the air. 2) Reduces heart rate. 3) Brings nitric oxide to the lungs and opens airways. 4) Brings better oxygen delivery to the body. 5) Reduces lactic acid buildup as more oxygen is delivered into the working muscles.
Humming increases nitric oxide in the body up to 15 fold. Nitric oxide opens up blood flow and helps lower high blood pressure.

Exercises To Increase Your B.O.L.T. Score

McKeown describes a series of exercises all designed to increase your tolerance for more normal levels of carbon dioxide. These exercises are not comfortable. Until your tolerance for more normal CO_2 levels increases, there is an incredibly strong desire to breathe. If you can work your way through this impulse, the sensitivity of your body to higher levels of carbon dioxide will decrease. You will be rewarded with an increase in exercise tolerance, improved metabolism, and a much calmer state of mind.

With exercise, all breathing should be through the nose, pushing as hard as is tolerable. You may occasionally need to mouth breathe if the exertion is very strong. Only with a B.O.L.T. >40 is your breathing volume likely to be normal. Any less and you are likely to overbreathe. With training, your B.O.L.T. should increase by 10-15 seconds in 6-8 weeks. Having a B.O.L.T. score of less than 20 at rest is an indication of chronic over-breathing.

The goal of the Breathe Light and Breathe Right exercise described in the book is to increase your tolerance for air hunger to 3-5 minutes. That is, for 3-5 minutes you exercise such that you feel an urge to breathe more, but you don't. You need to be just on the edge of what you can handle here, but no more.

A warm up with breath holding can increase CO_2, which will make more oxygen available when you do work out or compete.

“To reap the most benefit from your physical training, you need to train your body to do more with less. Incorporating this concept into your training will result in improved breathing economy and an increase in your athletic performance, along with reduced breathlessness and lactic acid during competition.”

There are three basic ways to reduce air intake during exercise: 1) Relax your body and take in less air. (This is hard to do if you have pushed into significant air hunger.) 2) Increase your exercise intensity while maintaining nasal breathing. (This would be a relative decrease in air intake.) 3) Practice breath holding on the outbreath during exercise. (Doing it on the outbreath will capture the valuable nitric oxide generated in your nasal cavities when you breathe back in through your nose.)

For competitive athletes who are actively training, to get the benefits of this kind of approach, do a mix of your regular high intensity training and the breath work at a ratio of about 30% to 70%. The 70% is done entirely with your mouth closed. Elite athletes have a greater tolerance for increased CO_2 levels, and VO2 max increases with a greater tolerance for CO_2.

When you change to nose breathing during exercise, your nose may run for a few weeks with exercise.

You can easily check to see if you are pushing too hard during physical exercise. Simply exhale and hold your breath for 5 seconds. Resume breathing. If your breathing when you resume is uncontrolled, you are pushing too hard.

You can have similar effects to high altitude training by working with breath-holding exercises. The exhalation is gentle, then the breath is held. After some 4-5 days of practice, oxygen saturation during the breath-holds will decrease to about 94% or lower, simulating an altitude of 2500-4000 meters.

It is important to not lose control of your breathing after a breath-hold. Continue to breathe through your nose, perhaps taking a few quicker breaths. The lower the B.O.L.T., the more likely this is to happen.

Breath-holds on the outbreath are incredibly valuable to athletes. You want to do this such that you recover in 2-3 breaths.

With children with asthma, they can usually hold their breath while walking about 30 paces in the first week of a training program that he developed. This can increase up to 10 paces a week up to 80 paces for many of them, which is pretty impressive.

Strengthening Your Diaphragm

To increase the strength of your diaphragm, McKeown recommends holding your breath on the out breath. At first you will feel some isolated spasms, followed by quicker and

more intense spasms. McKeown feels that this is the best way to strengthen respiratory muscles.

(I was thinking about this and did a simple isometric of pulling my breath in and continuing to pull without locking my throat. This very effectively engaged my diaphragm.)

The advantage to McKeown's approach would be that it would increase your tolerance to CO_2.

Altitude Preparation

To prepare for high altitude, McKeown recommends that you do 5-10 daily maximum breath-holds on the out breath for 2-3 months. Breath-hold time is a useful predictor of susceptibility to acute mountain sickness.

You can watch O_2 saturation decrease with breath-hold exercises. With a Pulse Oximeter, normal at sea level is 95-99%. With practice and an increased ability to tolerate longer breath-holds, the O_2 saturation will decrease during the practice. If you bring the O_2 saturation below 91% you will stimulate an increase of erythropoietin by 24%. Erythropoietin increases formation of red blood cells.

McKeown describes a way to simulate a high altitude while walking using breath-holds. What he has you do is to hold the breath while walking, jogging, running, cycling and swimming.

Flow States and Stress Reduction

McKeown describes flow states that can be attained through having a high B.O.L.T. score, using meditation, and developing awareness of mind.

In situations where you are stressed, such as before an important event or activity, McKeown recommends what he calls a breathing recovery exercise to improve brain oxygenation. What he suggests is to perform a series of small breath-holds. Follow these instructions: 1) Take a small silent breath in and out through your nose. 2) Hold your breath for 2-5 seconds. 3) After each breath-hold, breathe normally for about 10 seconds. Do not interfere with your breathing in this step. 4) Repeat this process for at least 15 minutes.

Breathing and appetite

Increasing your B.O.L.T. score will decrease your appetite. People who work with this will sometimes spontaneously eat better. There is less emotional eating. Food choices will improve. If the pH of the body becomes more acidic, the person will want to over-

breathe to offload the CO_2 which is acidic. Processed foods are more acidic and will cause some tendency to over-breathe. Chronic over-breathing will tend to increase pH.

Our bodies are adapted to having this short term as in an acute stress. We are not physiologically designed to handle this long term. McKeown speculates that some of the attraction to processed foods is that they help rebalance pH. With chronic over-breathing, we may crave acid foods to balance the increase in pH. A change in breathing patterns may spontaneously change a person's diet.

Affects On The Heart

A slight reduction in CO_2 in the arterial blood will increase the heart rate. This increase may reach levels of tachycardia and related arrhythmias.

If a person chronically sighs, this will tend to blow off a lot of CO_2, leading to an increased heart rate and perhaps, feelings of anxiety or panic. To help with sighing, McKeown recommends that the person hold their breath for about 10 seconds, or alternately, they could swallow.

Increased breathing volume correlates to moderate to severe heart failure. In one study of patients with congestive heart failure, breathing volumes were from 15.3-18.5 liters per minute, with normal being 4-6 liters per minute.

If you think about it, if you over-breathe, oxygen will not be able to be off-loaded to the heart muscle to make energy. The heart will be relatively starved of oxygen.

Exercise Induced Asthma

To avoid exercise induced asthma: 1) Work on improving your B.O.L.T. score. 2) Breathe only through your nose. 3) Make sure to warm up.

Warm up at least 10 minutes to forestall exercise-induced asthma. A good way to warm up is a fast walk with a medium to strong breath-hold every minute or so. Next, pick up the pace to where you have an urge to open your mouth, and then back off a bit.

Asthma

There are several hypotheses for the cause of asthma. The hygiene hypothesis has good evidence, and air quality is certainly an issue, and there is excellent evidence for that as well. But another, perhaps deeper, cause might lie in how we breathe. The average adult with asthma breathes 10-15 liters of air per minute; again, normal being 4-6 liters per minute.

“Normal breathing during rest involves regular, silent abdominal breaths drawn in and out through the nose. People with asthma, on the other hand, display habitual mouth breathing with regular sighing, sniffing, and visible movements of the upper chest.” As asthma worsens, breathing volume increases.

In one study, when breathing volume was decreased from 14 liters to 9.6 liters, symptoms decreased 70%, and the need for reliever medication decreased 90%. Steroids were cut 50%.

Step one in asthma is to breathe with the nose. This is vital. Air by mouth is unconditioned, unfiltered, and inadvertently increases breathing volume, blowing off much more CO_2 in the process. You lose CO_2’s natural opening of the airways and the nitric oxide from the nasal passages.

Swimming involves a fair amount of breath-holding which can help oxygenation. Asthmatics tend to favor swimming, even with the chlorine exposure.

Zero % of water polo players had evidence of bronchoconstriction as compared to 55% of soccer players and 50% of basketball players. Water polo is played at the bottom of a pool requiring prolonged periods of breath-holding.

The best time to test B.O.L.T. is early AM. When this is > 20 seconds, wheezing, coughing, breathlessness, and chest tightness will disappear. At 20 seconds, asthma can still be triggered. At 40 seconds, it is very unlikely.

Pace Exercise Training

The purpose of this exercise is to increase your tolerance for higher levels of CO_2 in the blood. This will allow more oxygen to be available for the tissues in the body.

With this exercise, walk at your normal pace. Breathe through your nose and settle into a rhythm that works for you. After some minutes walking this way, breathe in about half way and hold your breath. Count your paces. After 15-25 paces, you will start to feel an urge to breathe that will get stronger and stronger as you hold your breath. Continue to hold your breath. Your diaphragm will really start to grab. You may notice some strong sensations in your abdomen and legs as you do this. When you have reached your limit, breathe in through your nose. Try to calm your breathing as quickly as possible. Repeat several times after you have had some time to recover.

Triangle Breathing

McKeown did not describe this exercise, but I found that it is quite helpful for increasing tolerance for CO_2 .

This is another walking exercise. Again, breathe only through your nose. Once you have settled into a normal pace for you, start to count your paces on the in-breath. Count to 4 or 5 or 6 paces, then start your outbreath, counting to 8 or 10 or 12. At the end of the out-breath, pause for 4 or 5 or 6 paces. So, the ratio is 1 pace in for every 2 paces out, and 1 pace for the pause.

What you will find here is that if you lengthen the breath, you will get to a place where there is a mild to moderate sense of needing to breathe more. It is not very pleasant frankly. What you want here is to be right on the edge of what you can tolerate without losing it and taking a heaving breath in through your mouth. 5-10 minutes of this type of training will be very good for resetting your CO_2 tolerance.

Simple Breath-Holding

This is just what it sounds like. Take a small breath in and hold it for as long as you can. Try to relax as much as possible when doing this. When it gets difficult, stretch, wiggle around, move your chest, etc. When you take a breath in, do it through your nose and try to calm it down as quickly as possible.