

4th Degree Blackbelt Grading Thesis

2 September 2020

Breathe less to perform better.

By Carl van Roon
(ITKD 4th Degree Grading Applicant)

In the Encyclopaedia of Taekwon-Do, General Choi Hong Hi lists 'breath control' (호흡 조절 or 'Hohup Jojul') as one of the six key elements explored in the 'theory of power'. The importance of breath control is also reflected to us in quotes from General Choi regarding the 'training secrets of Taekwon-Do' in which he famously stated that a Taekwon-Do practitioner should aim "To bring the movement of eyes, hands, feet and breath into a single coordinated action" and "To exhale briefly at the moment of each blow except in a connecting motion".

If we go back in time and explore history, we can easily see how intertwined the discipline of 'breath control' is with the development of Martial Arts, particularly in Asia. The use of the 'breath' as a means to maximise general well-being and enhance Martial Arts training dates back at least as far the rise of the Shaolin temple and a pilgrimage made by a legendary Indian Buddhist monk known as Bodhidharma in the 5th Century AD which would have a massive role to play in the development of Martial Arts throughout Asia, including those in Korea and Japan which would later lead to the evolution and development of modern day Taekwon-Do as created by General Choi Hong Hi.

Now for me personally, as a child, you could say that my own 'breath control' was severely compromised. Long before I took up Martial Arts I suffered from severe asthma. I'd run across my parent's living room and be wheezing and out of breath within just a few steps. I was prescribed broncho-dilating medication by my doctor designed to open my airways, but it wasn't until I took up swimming that I learnt to control my breathing and calm myself down. In a short time, the asthma symptoms not only disappeared, but the need to use the medication I had been prescribed quickly disappeared too. It was fascinating to see this play out and my parents were not so much grateful to improve my athletic performance but much more importantly they were thankful that the breathing techniques required for swimming had helped me to have a better quality of life.

As a full time Taekwon-Do Instructor and Coach, I've now come full circle and I have been investigating breathing again, as I'm always fascinated by the opportunity to explore new ways that we can enhance our understanding of the human body as our vehicle as Taekwon-Do practitioners.

What prompted this interest in breath control most recently was finding myself awe struck by the exceptional breath holding abilities of magicians and free divers. In each case, I found myself beyond impressed by their ability to more efficiently extract oxygen and distribute this oxygen throughout their bloodstream under stress. World record holders such as free diver Herbert Nitsch for example, have been able to dive as deep as 214 metres on a single breath hold while Aleix Segura, holds the current record for holding his breath for a staggering 24 minutes and 3 seconds under water. Naturally, as a self-admitted 'Martial Arts maniac' my immediate thought was "How could we use these same breathing techniques to optimise our performance in Taekwon-Do? Could we apply the same principles and take our use of 'breath control' to the next level? What do these individuals understand and more importantly practice that we may not have a grasp of on scientific and practical level in Taekwon-Do?"

As is commonly documented, General Choi repeatedly made it clear that he intended for Taekwon-Do to be an evolved, scientifically sound Martial Art and emphasised the importance of the breath in fundamental training: "*Controlled breathing not only affects one's stamina and speed but can also condition a body to receive a blow and augment the power of a blow directed against an opponent.*" The deeper examination of 'breath control' therefore appealed to me as an exciting area for more exploration and rather than writing this thesis about a topic I had more experience in, it's been satisfying to explore a new topic and learn a lot in the process. Most specifically one concept proved most alluring: the paradoxical idea that one could 'breathe less to perform better'.

I know, it sounds backwards doesn't it? Yet the idea is now entirely accepted and grounded in credible science by experts working in this field. The concept of breathing less to perform better lies in the training of an ability known as 'CO₂ tolerance' and it is one that is manipulated by not only free divers and breath holding experts, but also by elite endurance athletes, MMA fighters and probably a host of past yogis, gurus and Martial Arts Masters from history who learnt from trial and error and applied their knowledge accordingly, even if they didn't have access to the technology that now allows us to understand the deeper science behind this phenomenon.

To begin our exploration of the topic, what are some basic conceptions that we have about breathing, on a fundamental level? When we breathe in, we draw in air as our diaphragm creates a vacuum or lower pressure space in our lungs that sucks in air. Some of this air is made of up oxygen (21% to be exact, with 78% being nitrogen and the remaining 1% being a mix of other gases including carbon dioxide). As we know, our lungs help us then extract the oxygen from the air, and then that oxygen is taken into our bloodstream where it binds to red blood cells known as 'erythrocytes' which then travel around the body to distribute oxygen to 'fuel' or power our physiological functions through various metabolic pathways, whether this be for athletic endeavours such as Taekwon-Do or otherwise.

So a basic deduction one might make at this point could be something along the

lines of: "If I take a big breath, that's more air, which contains more oxygen than a small breath which would contain less oxygen." Another simple deduction might be: "My mouth is bigger than my nose, so if I breath through my mouth I'll be able to get a bigger breath and get more oxygen." Finally one more seemingly logical statement might be: "The faster I breathe, the more oxygen I'll be able to get in." Unfortunately, all of these seemingly common sense ideas are in contradiction with what scientific evidence shows; individuals who have trained their breathing to be exceptional understand know that taking smaller yet deep breaths through the nose (which is linked to our diaphragm via our nervous system) at a lower frequency is the best way to enhance the efficiency of our breathing, and it's simple to learn and incorporate into Taekwon-Do training. (For more information on these techniques, please refer to a summary of practical breathing guidelines and exercises at the end of this thesis).

To help us explore research into this area further, let's turn to the acclaimed work of World renowned breathing specialist Patrick G McKeown who discusses key points to enhancing the efficiency of our breathing in his book 'The Oxygen Advantage: Proven Breathing Techniques for a Healthier, Slimmer, Faster, Fitter You'. To quote the book and it's importance for us as Taekwon-Do practitioners and human beings: "The secret to your health, fitness and overall wellbeing lies in the most basic and overlooked aspect of your workout: how you breathe. Developing body strength while ignoring breathing strength is counterproductive."

So what is the basic premise McKeown's book 'The Oxygen Advantage'? Essentially, we all breath too much! 'Chronic overbreathing' as McKeown points out, leads to a myriad of health and fitness issues. The issue may stem from the fact that as a society we tend to think about the quality and quantity of what we eat and drink, but don't do the same with how we breathe (discounting air quality / toxins / pollutants etc which we do tend to consider).

So why is 'chronic over-breathing' a problem and what does that even mean? Put simply, the amount of air that we breathe in any given breath doesn't actually correlate with how much oxygen gets to our muscles, organs etc. Instead, what paradoxically dictates how much oxygen our blood can carry via. haemoglobin(the heme iron that carries oxygen on erythrocytes or red blood cells) is the amount of CO₂ of carbon dioxide in our blood stream. I.e. the greater the concentration of carbon dioxide in our bloodstream, the more oxygen will be triggered to be released from the oxygen carrying capacity of the haemoglobin of our red blood cells. So what we need to know as Taekwon-Do practitioners is that the more we breathe in terms of frequency and big shallow mouth breathing ('chornic over-breathing') the more we flood our blood stream with a greater and greater amount of oxygen rather than increasing carbon dioxide concentration. So there is a paradox at play here, the more we breathe, the less efficiently the balance swings to allow carbon dioxide to trigger the release of oxygen from red blood cells in the bloodstream. So essentially, we need to breathe less to breathe right.

But how do we do this? How do we breathe correctly? The number 1 tip from experts like Patrick McKeown is to avoid mouth breathing and instead, retrain

ourselves to rely on nasal breathing, even during exercise whenever we can (unless the intensity is close to maximal in which case mouth breathing may temporarily become necessary). Initially, 'air hunger' will result from such retraining oneself to rely on nasal breathing as it imposes approximately 50 percent more resistance to the air stream than mouth breathing during wakefulness, which results in 10-20 percent more oxygen uptake (a consequence of a greater CO₂ tolerance and therefore concentration in the blood as previously explained), thereby elevating our performance and recovery from training as Taekwon-Do practitioners. An example of a study that supports this concluded that: 'During exercise, nasal breathing caused a reduction in FEO₂ (fraction of expired air that is oxygen (O₂%)), indicating that on expiration the percentage of oxygen extracted from the air by the lungs is increased.' (Morton, King, Papalia 1995 Australian Journal of Science and Medicine in Sport. 27, 51-55). On an aside note, the Encyclopaedia of Taekwon-Do makes mention as to the importance of learning to hide 'air hunger' and control one's breathing for an additional purpose beyond physiological adaptation, with General Choi stating the tactical importance of hiding one's fatigue: "Students should also practice disguised breathing to conceal any outward signs of fatigue. An experienced fighter will certainly press an attack when he realizes his opponent is on the point of exhaustion."

Another key advantage to taking deeper nasal breathes at lower frequency is in the directly link between nasal/diaphragmatic breathing and the activation of the parasympathetic or resting response on a nervous system level. Mouth breathing (which is related to chest breathing) is in contrast with this, in that it is directly associated to the triggering of the sympathetic or 'fight or flight' nervous system response that leaves individuals more anxious, results in poorer sleep, decreased concentration levels / focus during training etc. Furthermore, while the benefits of diaphragmatic breathing have long been emphasised in forms of yoga, martial arts, pilates and other disciplines, it is only more recently that nervous system activation research has confirmed that nasal breathing exclusively allows for the diaphragm to be 'dialed up' or recruited via the vagus nerve. This recruitment of the 'diaphragm' does not occur with chest breathing / mouth breathing. Another key element of consideration for Taekwon-Do practitioners is that research is now reinforcing the importance of the diaphragm for stabilising the trunk during rotation far beyond what was perceived as it's main role as a respiratory muscle. Recent evidence suggests that to stabilise the spine and core, the diaphragm is best recruited by nasal breathing, and continues to be a topic for research in the scientific community. The implications for Taekwon-Do practitioners is essential and already well known within the art as established by General Choi who mentions this in the Encyclopaedia of Taekwon-Do: "*A sharp exhaling of breath at the moment of impact and stopping the breath during the execution of a movement tense the abdomen to concentrate maximum effort on the delivery of the motion, while a slow inhaling helps the preparation of the next movement. An important rule to remember; Never inhale while focusing a block or blow against an opponent. Not only will this impede movement but it will also result in a loss of power.*"

Another area in which 'breath control' is useful to Taekwon-Do practitioners, but is

less explored in Taekwon-Do literature regards an individual's ability to manipulate or activate more of a sympathetic vs parasympathetic nervous system response through breathing. With simple breathing exercises we can prepare our body to maximise time for recovery through better rest and sleep, reduce inflammation and therefore prevent or limit future injury.

Being able to access more of a parasympathetic state also helps with reduced perceptions of pain as reflected in this quote from the Taekwon-Do Encyclopaedia which mirrors this idea: *"Through practice, breath stopped in the state of exhaling at the critical moment when a blow is landed against a pressure point on the body can prevent a loss of consciousness and stifle pain."* Such breathing approaches allow us to be able to push harder while keeping calmer under intense pressure or stress, whether that be in competition, grading or simply pushing oneself to conquer one's own 'inner mountains' as a Martial Artist without losing focus in the present moment or burning out under the intensity of too long a period spent in a sympathetic state (fight or flight).

I can attest to all of this through my own experiences, having applied such principles by going into a deep meditative state of complete relaxation between half a dozen fights at World Championships, and anecdotally attribute much of my past success to the ability to be able to switch off and down regulate adrenaline and the stress response with deep breathing and relaxation. From the scientific perspective, a recent study into oxidative stress due to exhaustive exercise reinforces this concept with: *"Results which demonstrated that relaxation induced by diaphragmatic breathing increased the antioxidant defense status in athletes after exhaustive exercise. These effects correlate with the concomitant decrease in cortisol and the increase in melatonin."* (Martarelli D1, Cocchioni M, Scuri S, Pompei P. Diaphragmatic breathing reduces exercise-induced oxidative stress). To summarise, stress hormones went down and rest hormones went up, while antioxidant effects were enhanced (protecting the athletes bodies against free radical damage due to the intense exercise).

So in a more practical sense, what do we actually mean by deep breathing? In Patrick McKeown's 2015 work on 'The Oxygen Advantage', he points out that a deep breath is often mistaken for a big breath but the two are anything but synonymous. A deep breath can be light, and quiet, yet reach the deepest alveoli (air sacks in the lungs responsible for the perfusion of oxygen into the bloodstream). This deeper breathing using the nose and therefore diaphragm allows for air to reach the deeper part of the lungs, where the blood flow is greater and therefore where oxygen perfusion into the bloodstream is more efficient. Mouth and chest breathing on the other hand, do not allow for this advantage.

Unsurprisingly perhaps, Taoist, Buddhist and yogic breathing methods advocate for quiet, slow breathing in a way that very much echos modern evidence surrounding such breath control practices which show that increasing our carbon dioxide tolerance allow us to more efficiently extract oxygen, calm our mind and body and recover more readily between training sessions. Taoist masters encourage advocates to breath so lightly that the fine nostril hairs which filter air as it passes in through the nose remain completely still. In the modern day,

Grandmaster Rhee Ki Ha, commonly referred to as the Father of Taekwon-Do in the United Kingdom and once described by General Choi Hong Hi as his "best student ever", reiterates this message of calm, light, relaxed breathing between movements in his book '*This is Taekwon-Do*' in which he states: "As we move we should feel light, relaxed and flowing like water. When we finish a movement [i.e. at the moment of impact] the body should become strong and hard like iron. The breath is how we can achieve this . . ."

A further advantage to nasal breathing not yet discussed is the the ability of the nose to filter, humidify and warm the air before enriching each breath with nitric oxide, none of which occur with mouth breathing. Nitric oxide is a substance that has been shown to increase arterial oxygen tension and reduce pulmonary vascular resistance, thereby allowing oxygen to cross from the lungs into the bloodstream more efficiently. Once again, more rapid, larger mouth breaths taken shallow from the chest do not allow for a greater concentration of nitric oxide to reach the lungs with each breath taken as per the nasal breathing for which we are evolved.

What about breath holding techniques, are these beneficial, being that the overall theme of this thesis seems to encourage a reduction in 'chronic over-breathing' which thereby increases carbon dioxide concentration and as we know now, enhances the use of oxygen? The answer is 100% yes. From a scientific perspective, breath hold training is basically like simulating altitude training and has similar benefits: "*Breath-hold training causes lower blood acidity, higher tolerance to anoxia, decelerated metabolism and an increase in Hct value, Hb and EPO concentration as well as the mass and volume of the lungs.*" (Schagatay et al., 2000, 2001, 2005, 2007, Bakovic et al., 2005, Prommer et al., 2007, De Bruijn et al., 2008, Richardson et al., 2008. Journal of Human Kinetics volume 32/2012, 197-210) Furthermore, on the breath hold topic, a 'bio-hack' discovered through breath holding research reveals that the human spleen can help elevate blood oxygen capacity through breath holds: '*The Spleen stores blood to a volume that may amount to about 200–300 ml, with 80% of the content consisting of hematocrite (Laub et al., 1993) The resultant blood oxygen capacity enables an increase in O2 concentration by 2.8–9.6% and more intense oxygen transport inter alia to the chest and other organs essential to breath-hold diving.*'

Put simply, to wrap up our exploration into the current state of scientific literature investigating 'breath control', the evidence is powerful and exciting. Personally, I thought I had a decent grasp of breathing mechanics and physiology but authors like Patrick McKeown have opened my mind. McKeown describes breathing as an important, overlooked avenue for enhancing athletic performance and well-being, where a lot of our general conceptions about breathing are based upon myths and 'common sense' advice rather than on scientific evidence.

In conclusion, as Taekwon-Do practitioners in the modern era we are generally careful in our considerations of nutrition, rest, hydration, training load, even mindset training yet breathing (outside of basic 'breath control' on the Dojang floor) might possibly be the key to elevating and enhancing much of our wellbeing as it

has been proven to be an underlying cause of compromised athletic performance, poor recovery, higher injury incidence, lower metabolism and more.

What will I be taking away from my recent research into breathing? Put simply, I'm going to breathe more slowly, and through my nose whenever possible!

On a daily basis, both on and more importantly off the Dojang mat, I'm looking forward to retraining myself to breathing in the way that we all did when we were born and for most of our history as a species (according to anthropological research): through our noses, which activates the vagus nerve to allow us to breathe deep into our lungs with the diaphragm and paradoxically, through breathing slower and less frequently to maximise oxygen exchange by manipulating CO2 concentration in the blood. I'm already feeling better just breathing as I finish writing this now.

— — — — —

Bibliography / References

General Choi Hong Hi.
Taekwon-Do Condensed Encyclopedia
1999

Martarelli D1, Cocchioni M, Scuri S, Pompei P.
Diaphragmatic breathing reduces exercise-induced oxidative stress
2011

Morton, King, Papalia
Australian Journal of Science and Medicine in Sport. 27, 51-55
1995

Patrick G McKeown.
The Oxygen Advantage: The Simple, Scientifically Proven Breathing Techniques for a Healthier, Slimmer, Faster, and Fitter You
2015

Rhee Ki Ha.
This is Taekwon-Do
2012

Schagatay et al., 2000, 2001, 2005, 2007, Bakovic et al., 2005, Prommer et al., 2007, De Bruijn et al., 2008, Richardson et al., 2008. Journal of Human Kinetics volume 32/2012, 197-210

— — — — —

Featured below are two introductory breathing exercises introduced to me by

Dave Wood, an Auckland based breathing specialist who has been helping me on my journey to better breathing!

To learn more from Dave, please visit his website Woody's Movement

Workshop: <https://wmw.co.nz/>

1) SMALL BREATH-HOLDS (Performed sitting down for 2-3 minutes)

Take a normal breath in and out through the nose.

Pinch your nose with your fingers to hold the breath for 5 seconds.

Let go of your nose and breathe in and out through your nose for 10 seconds.

Just breathe as normal for ten seconds.

And again, normal breath in, normal breath out and pinch your nose.

When you let go, breathe in through nose.

Breathe as normal for 10 seconds. Don't make any changes to your breathing. Just breathe as normal.

You should not feel stressed while doing the exercise. If the air hunger is too much, then hold the breath for 3 seconds only.

Objective:

The objective of this exercise is to prepare the body for a tolerable feeling of breathlessness. By holding the breath for short periods of time, the gas nitric oxide (NO) pools inside the nasal cavity, and the gas carbon dioxide (CO₂) slightly increases in the blood. Upon resumption of breathing, breathe in so as to carry NO from the nasal cavity into the lungs. As you hold your breath, you may feel a light hunger for air. This signifies that the CO₂ is increasing in your blood.

Both gases play an important role in opening the airways, improving blood circulation and allowing more oxygen to be delivered to the cells. This exercise is ideal for a warm-up, as well as to help reduce stress, asthma symptoms and breathing recovery following physical exercise.

Results:

- Introduce air hunger
- Harness nasal nitric oxide
- Calming exercise in times of stress

2) BREATHING LIGHT (Performed sitting down for 2-3 minutes)

If sitting, imagine a piece of string gently pulling you upwards towards the ceiling.

Imagine and feel the space between your ribs widening.

With your mouth closed, jaws relaxed, breathe normally in and out through your nose.

Place your hands on your chest and tummy or on your lap.

Focus on the air flow as it moves in and out of your nose. Feel the slightly colder air entering your nose, and feel the slightly warmer air leaving your nose.

When you are able to follow your breathing, take a short slow breath into the nose and allow a gentle relaxed breath out. Breathe 80% of your normal breath in a slow and gentle manner. Breathing should be so light, quiet and still.

It is very important not to consciously interfere with your breathing muscles or restrict your breathing during this exercise. Don't tense your stomach to reduce your breathing.

The goal is to feel a want or 'hunger' for air.

To have a feeling that you would like to take in a bigger breath but you do not.

Results:

- Improve oxygen uptake and delivery
- Harness nasal nitric oxide
- Improve tolerance to carbon dioxide
- Normalize breathing volume
- Meditation to anchor the mind to the breath
- Improve concentration