Intermittent hypoxic training...

Subject | **...as an effective therapy for cardiovascular diseases**

Dr. Stephan Bortfeldt

Stress induced cardiovascular and metabolic diseases are a global global problem in all industrialised countries and consume billions for medical and pharmacological treatment, disability, rehabilitation and premature disability. In particular, work stress has become a significant social health risk associated with increased cardiovascular morbidity and mortality.[1]

The current risk factor model of orthodox medicine cannot do justice to the complexity of highly developed biological systems. The underlying biochemical, molecular and physiological regulatory mechanisms are not taken into account in therapy, so that the predictability of undesired events remains limited. Today, patients take millions of drugs that are of no use to them and which often even harm them. Here, complementary medicine offers diagnostic and therapeutic alternatives.

If we summarise the findings of basic research, four pathomechanisms are essentially responsible for the development of chronic diseases: inflammation, chronic metabolic acidosis, mitochondriopathies and regulatory disorders of the autonomic nervous system with increased sympathetic tone and reduced vagotone. In connection with chronic inflammation, dysbiosis is of particular importance.

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Since 2010, Dr Stephan Bortfeldt has been a lecturer for companies and professional associations in the fields of prevention, stress disorders, heart rate variability, orthomolecular medicine, functional medicine, occupational health management, nutritional counselling and Intermittent Hypoxia Hyperoxia Therapy (IHHT). He is the first and co-author of several scientific publications on intermittent hypoxia, heart rate variability and the autonomic nervous system.

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Numerous therapeutic procedures for these regulatory disorders have been known in complementary medicine for decades, but have not yet been sufficiently established. In the following article, we would like to familiarise you with a therapy that has been used for more than 30 years, but is still little known, especially in western industrial countries: Intermittent Hypoxia Hyperoxia Therapy, or IHHT for short.

Molecular Mechanisms

Hypoxia is a double-edged sword. In sports medicine it has long been part of the therapeutic routine under the term altitude training. Uncontrolled hypoxia, for example in obstructive sleep apnea (OSA), leads to hypertension and an increased cardiovascular risk through chemosensory activation of the sympathetic nervous system.[2] Ischemic inflammation and tissue necrosis are other dreaded complications.

However, intensive research over the past decades in the field of intermittent hypoxia has shown that the human organism has a number of adaptation mechanisms that adapt the body to the conditions of hypoxia. These include both biochemical reactions and genetic transcription processes.[3]

Under hypoxic conditions, the O2-consuming oxidation step to degrade the hypoxia-induced factor (HIF-1α) is inhibited, this protein is enriched and genes that improve the oxygen supply to the tissue are expressed by activation. These include erythropoietin and growth factors for angiogenesis (VEGF).[4]

These and other effects lead to improved myocardial ischemia tolerance and protection against ischemia-induced reperfusion damage.[5] Adaptation to hypoxia also includes the regulation of nitric oxide (NO) synthesis with correction of NO storage and inhibition of overproduction resulting in the formation of toxic RNA (keyword: nitrosative stress).[6]

The increased formation of lactate from glucose under hypoxia has long been known under the term Pasteur Effect. In addition, activation of pyruvate dehydrogenase kinase 1 (PDK1) via inhibition of pyruvate dehydrogenase leads to reduced acetyl CoA formation and thus to less substrate for the citrate cycle. The resulting weakening of oxidative phosphorylation reduces the formation of ROS by ineffective electron transport in the respiratory chain.[7] Another positive influence on glucose metabolism is the increased expression of insulin-dependent glut-4 (glucose transporter), which is required for the intracellular introduction of glucose.[8]

Superoxide dismutase and glutathione peroxidase are the most important antioxidants required by the organism to protect against ROS and other oxidative processes.

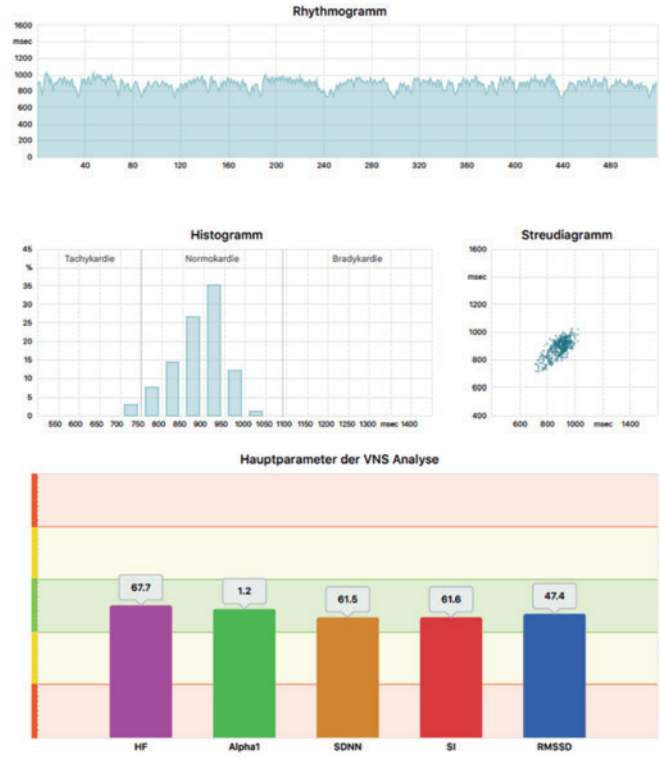
Again, controlled hypoxia has been shown to stimulate synthesis.[9]]

Mitochondriopathies with reduced ATP production are the major cause of numerous chronic diseases, particularly in the nervous system. However, cardiovascular, metabolic and tumour diseases are also characterised by failure of mitochondrial ATP production. Despite molecular adaptation, hypoxia leads to apoptosis of damaged mitochondria, while healthy mitochondria are replicated and can supply the cells with energy.

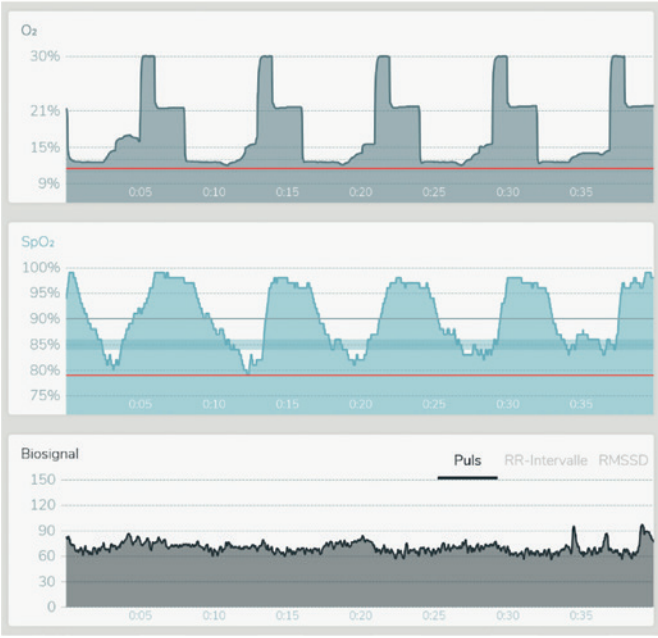
Cell metabolism is therefore reprogrammed.

This method is unique and, in addition to the many molecular mechanisms mentioned above, the main reason for the success of IHHT. It is particularly important to note that the combination of hypoxia and hyperoxia protects the cells from excessive hypoxia and its deleterious consequences.[10] The task is to find the balance between toxic and therapeutic doses. The administration of pure oxygen does not necessarily improve mitochondrial function, as defective mitochondria cannot make use of the excess oxygen..

The above-mentioned molecular and genetic processes result in numerous indications for the use of IHHT in practice: chronic and stress-related diseases, diabetes, cardiovascular diseases, neurodegenerative disorders including Lyme disease, eye diseases, dementia, Alzheimer's disease, Parkinson's disease, depression, burnout, CFS, psychovegetative diseases and oncological diseases – these are all indications for the use of IHHT in practice. In short: IHHT is used for all mitochondrial dysfunctions.



1 Evaluation of HRV and ANS parameters



2 Graphical evaluation of the IHHT at MITOVIT®. Setting of biofeedback adaptive hyperoxia: automatic adjustment of O2 keeping SPO2 between the set 90-79 %.

The method for increasing performance and training control has also proven its worth.

The analysis of the autonomic nervous system as the diagnostic basis of IHHT

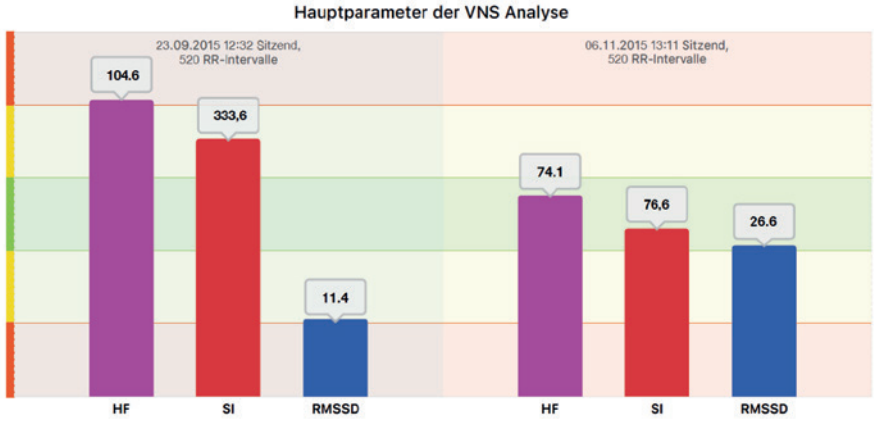
As mentioned above, disorders of the autonomic nervous system (ANS) also play a key role in the genesis of chronic diseases. There is no relevant disease that is not associated with a disturbance in ANS regulation. Dysbalances of the autonomic nervous system are typically characterised by a hyperactive, energy-consuming sympathetic system and a hypoactive parasympathetic system. Over time, this excessive energy consumption leads to premature aging and disease.[11] Physical decay and frailty are also the result of irreversible changes in this dynamic and highly complex system.[12] For this reason, the measurement of ANS activity is also the basis for IHHT therapy.

Since the vegetative agent reacts directly and variably to hypoxia, the intensity of the therapy and the duration of the hypoxic and hyperoxic intervals are adapted to the ANS regulation. Too much sympathetic stress can thus be avoided. The easiest way to measure the ANS is heart rate variability (HRV), a mathematical analysis of the beat-to-beat variability of normal heart beats or the RR intervals in the ECG. These fluctuations of the heart rate show the changes in the autonomous cardiac regulation, because the sinus node in the atrium of the heart is permanently modulated by sympathetic and parasympathetic impulses. This procedure has been established in science for decades and has a high prognostic value in prevention and risk stratification. [13] Furthermore, the method for therapy control is ideally suited.

The most important time domain parameters are the standard deviation of all RR intervals (SDNN) as an expression of total variability, the RMSSD (Root Mean Square of Successive Differences) as a marker for the parasympathetic nervous system and the so-called stress index (SI) as an indicator of sympathetic activity (Fig. 1)..

ANS Analysis and IHHT in practice

The autonomic nervous system is measured while sitting or lying down and at rest; the analysis takes about seven minutes. In the ANS analysis shown here, 520 RR intervals are recorded in the so-called rhythmogram. This rhythmogram shows the temporal changes of the RR distance from beat to beat and already clearly illustrates the physiological fluctuations of the heart rate.
The histogram and the scatter diagram (Poincaré plot) show the heart rate variability in another graph.



3 ANS Analysis in patient view before and after 10 IHHT sessions (HF=Pulse, SI=Sympathetic, RMSSD=Parasympathetic)

4 IHHT session

Due to the broad spectrum of indications for the application of IHHT and the fact that these indications and diseases are the main reasons for the deterioration of autonomous regulation in Western civilisation, the combination of diagnostics and therapy with ANS analysis and IHHT is ideal for therapeutic success. The improvement of the autonomous regulation serves as an optimal therapy success control. The ANS analysis we use contains the so-called risk parameter Alpha-1, which allows conclusions to be drawn about the interactions of the individual vegetative control loops. It enables the assessment of the general ability of the organism to react to disturbances.

In particular, severe diseases and frailty in old age lead to a loss of complex dynamics and a maladaptive reaction to pertubations, which can be mapped with Alpha 1.[12]

At the first IHHT session, the real-time HRV contained in the MITOVIT® system and ANS analysis should be recorded. Thus, the individual stress stimulus of hypoxia on the autonomic nervous system can be documented. The first IHHT session starts with a fully automated hypoxia test. This hypoxia test serves to determine the initial oxygen concentration with which the oxygen saturation in the blood (SPO2) reaches below 90%. Only under 90% SPO2 a physiological effect of the therapy can be expected.

After some applications, the oxygen concentration should be adjusted and an SPO2 range of 85%- 80% should be aimed at.

The biofeedback program in the system automatically adjusts the oxygen concentration permanently in order to achieve optimum results and to prevent the oxygen concentration from falling below the safety value (see Figure 2).

The application of IHHT in the practice is very pleasant for the patients and is usually carried out while lying down. If necessary, however, the therapy can also be carried out in a stress state.

The breathing mask allows alternate breathing of oxygen-reduced air (hypoxia) and, depending on the setting, either normoxia, hyperoxia or adaptive hyperoxia (a mixture of normoxia and hyperoxia).

Adaptive hyperoxia combines the respective advantages of normoxy and hyperoxia.

This setting leads to a rapid regeneration during the recovery phase due to hyperoxia and enables a faster reaching of the therapeutic range of less than 90% SPO2 during the subsequent hypoxia phase.

Hypoxia influences autonomous regulation via various neuronal control mechanisms.[14] Therefore in stress-related disorders, excellent relaxation in the autonomous nervous system occurs using IHHT, which can be documented by ANS analysis (Fig. 3).

The patients' safety during treatment is ensured by two pulse oximeters, which permanently monitor the oxygen content in the blood and prevent the SPO2 from falling below the set safety value by automatically supplying more oxygen again. Patients can thus be left alone during the 40-minute treatment.

To achieve a lasting effect, at least ten sessions should be performed. The treatment should be performed two to three times a week.

Summary

For the substantial and causal therapy of many chronic diseases, IHHT is an outstanding therapeutic option with high patient acceptance and excellent success due to the broad spectrum of indications and the diverse biochemical regulation processes. At the same time, the IHHT method can be ideally combined or supplemented with all regulatory and complementary therapy options. If one considers holistic inflammation,

dysbioses, acidoses, mitochondriopathies and autonomous regulatory disorders as the systemic basis of these diseases, IHHT has a positive effect on all these disorders due to the evolutionary-biological adaptation reaction of the organism to hypoxia.

Through the reprogramming of mitochondrial cell metabolism, however, states of exhaustion can also be treated preventively without profound molecular changes and worsening can be avoided. IHHT can also be used to improve the performance of athletes and sportspeople, since the ideal functioning of mitochondria is also of great importance in sports. As in sports, the body reacts in the hypoxia phase by increasing blood pressure and frequency, reducing O2 saturation and stimulating the synthesis of superoxide dismutase and glutathione peroxidase as natural antioxidants. In the hyperoxia phase the body reacts with oxygen radical formation as a stimulus for the defence systems, i.e. the organism simulates the health-promoting properties of physical training while the patient is resting. For many patients, this is a situation that offers the greatest possible relaxation with excellent cell training modulation at the same time.

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More on the topic

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