

This comprehensive clinical guide comprised of series of articles details how hyperbaric oxygen therapy (HBOT) utilizes increased atmospheric pressure to dissolve high concentrations of oxygen directly into the blood plasma, far exceeding the capacity of red blood cells alone. By reaching this state of oxygen supersaturation, the treatment serves as a powerful catalyst for neurological repair, the mobilization of stem cells, and the reversal of biological hallmarks of aging such as the shortening of telomeres. The clinical success relies on an accurate adoption of pressure, where specific depths are tailored to treat either brain-related conditions or systemic physical injuries. The guide functions as an educational roadmap for the therapeutic application of HBOT, outlining its synergistic potential with regenerative medicine while maintaining strict protocols for patient safety.

Disclaimer

The following recommendations made by Waylen Allen Limited does not constitute a medical recommendation and is intended for information & educational purposes only. While studies support the effectiveness of hyperbaric oxygen therapy when used to help treat various medical conditions, individual results may vary. Always ask your doctor about all treatment options.

Oxygenating the Brain: How HBOT Transforms Neurological Treatment

February 12, 2024

Hyperbaric oxygen therapy (HBOT) has emerged as a promising treatment option for various neurologic disorders. The increased oxygen levels in the blood have been shown to have a positive impact on the brain and nervous system, leading to potential benefits for patients with neurologic conditions.

Enhancing Oxygen Delivery to the Brain

One of the key mechanisms behind the effectiveness of HBOT is its ability to enhance oxygen delivery to the brain. By increasing the oxygen concentration in the blood, HBOT helps to compensate for

reduced blood flow or oxygen supply to the brain that may occur in neurologic disorders. This can promote the healing and regeneration of damaged brain tissue, as well as improve overall brain function.

Neuroprotective Effects

HBOT has also been found to have neuroprotective effects, meaning it can help protect the brain from further damage. In conditions such as traumatic brain injury, stroke, or neurodegenerative diseases, the brain is often subjected to oxidative stress and inflammation, which can exacerbate the damage. HBOT has been shown to reduce oxidative stress, suppress inflammation, and promote the production of growth factors that support brain cell survival and repair.

Evidence-Based Benefits

The use of HBOT for neurologic disorders is supported by a growing body of scientific evidence. Numerous studies have demonstrated its effectiveness in improving outcomes for conditions such as:

- Stroke
- Traumatic brain injury
- Cerebral palsy
- Multiple sclerosis
- Autism spectrum disorders
- Alzheimer's disease

For example, a study published in the journal *Neurology* found that HBOT significantly improved cognitive function and quality of life in patients with chronic stroke. Another study published in *Brain Injury* showed that HBOT reduced brain edema and improved neurological outcomes in patients with traumatic brain injury.

Neurologic HBOT protocols

In general, HBOT protocols for the brain and central nervous system range in pressure from 1.3 ATA to 2.0 ATA. The more acute the injury, the less HBOT is typically needed and the more chronic, the more HBOT will be required to see improvements. As with most protocols, HBOT is best used in synergy with other modalities such as other technologies, practices, practitioners, and a comprehensive laboratory assessment, if there is time.

Conclusion

HBOT holds promise as a non-invasive and potentially effective treatment option for neurologic disorders. By enhancing oxygen delivery to the brain and exerting neuroprotective effects, HBOT may help improve outcomes and quality of life for patients with conditions such as stroke, traumatic brain injury, and neurodegenerative diseases. As research in this field continues to advance, HBOT has the potential to become an integral part of neurologic care.

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Seeing Clearly: The Role of Hyperbaric Oxygen in Eye Health

February 5, 2024

Hyperbaric Oxygen Therapy (HBOT) has gained significant attention in recent years for its potential in treating various medical conditions. While HBOT is commonly associated with wound healing and decompression sickness, its benefits extend beyond these areas. In this article, we will explore the remarkable potential of HBOT in treating eye conditions.

How Does HBOT Work for Eye Conditions?

HBOT involves breathing pure oxygen in a pressurized chamber, which allows the lungs to take in a higher concentration of oxygen than what is possible at normal atmospheric pressure. This increased oxygen supply is then carried by the bloodstream to all parts of the body, including the eyes.

For eye conditions, HBOT helps by:

1. Increasing oxygen delivery to the eye tissues
2. Enhancing the body's natural healing processes
3. Reducing inflammation and swelling
4. Promoting the growth of new blood vessels

Conditions That Can Benefit from HBOT

HBOT has shown promising results in the treatment of various eye conditions, including:

- Retinal artery occlusion
- Central retinal vein occlusion

- Diabetic retinopathy
- Macular degeneration
- Optic neuritis
- Corneal ulcers
- Chemical burns

Studies have demonstrated that HBOT can improve visual acuity, reduce macular edema, and promote the regeneration of damaged retinal cells. It can also help in the management of ocular complications associated with diabetes.

What to Expect During an HBOT Session

During an HBOT session for eye conditions, the patient is placed in a hyperbaric chamber, which is then pressurized to the desired level. The patient breathes oxygen through a mask, hood, or nasal cannula while the pressure is maintained for a specific duration, typically ranging from 60 to 120 minutes.

HBOT is a painless and non-invasive procedure. Patients may experience a sensation of fullness in their ears, similar to what is felt during air travel or diving. This can be relieved by swallowing or yawning. The number of sessions required depends on the severity of the eye condition and the individual's response to treatment but typically ranges from 1.5 to 2.0 ATA.

Is HBOT Safe for Eye Conditions?

HBOT is generally considered safe when performed under the supervision of trained medical professionals. However, as with any medical treatment, there are potential risks and contraindications. It is essential to consult with an ophthalmologist or a hyperbaric medicine specialist to determine if HBOT is suitable for your specific eye condition.

Some contraindications for HBOT include:

- Untreated pneumothorax (collapsed lung)

- Uncontrolled seizures
- Severe chronic obstructive pulmonary disease (COPD)
- Pregnancy
- History of ear surgery

Also, of note, cataracts may grow faster inside a hyperbaric environment if they are already present before treatment. This doesn't typically happen unless going to deeper pressures in the chamber i.e. 2.0 or greater and many treatments are undertaken.

Conclusion

Hyperbaric Oxygen Therapy (HBOT) holds great promise in the treatment of various eye conditions. By increasing oxygen supply to the eyes, HBOT can enhance healing, reduce inflammation, and promote the regeneration of damaged tissues. However, it is essential to consult with a medical professional to determine if HBOT is suitable for your specific eye condition.

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Enhancing Cancer Care: The Synergistic Power of HBOT

January 29, 2024

While HBOT is commonly used to treat conditions like decompression sickness and non-healing wounds, its potential benefits in cancer treatment have been gaining attention in recent years. In this article, we will explore the use of HBOT as an adjunctive therapy for cancer and its potential mechanisms of action.

Enhancing Oxygenation to Fight Cancer

One of the hallmarks of cancer is the development of a hypoxic (low oxygen) microenvironment within tumors. This hypoxia can promote tumor growth, angiogenesis, and resistance to conventional cancer treatments. HBOT aims to counteract this hypoxia by delivering high levels of oxygen to the body.

Studies have shown that increased oxygen levels can have several anti-cancer effects. Firstly, oxygenation can enhance the effectiveness of radiation therapy, which relies on the production of reactive oxygen species to induce DNA damage in cancer cells. By increasing oxygen levels, HBOT can potentially enhance the cytotoxic effects of radiation therapy.

Secondly, oxygenation can inhibit the growth and spread of tumors. Cancer cells thrive in a low-oxygen environment, but high oxygen levels can impede their ability to proliferate and metastasize.

Additionally, oxygenation can stimulate the immune system, promoting the body's natural defense mechanisms against cancer.

Potential Mechanisms of Action

While the exact mechanisms underlying the anti-cancer effects of HBOT are still being investigated, several theories have been proposed. One hypothesis suggests that HBOT can inhibit the formation of new blood vessels, a process known as angiogenesis, which is crucial for tumor growth and metastasis.

Another theory suggests that HBOT can modulate the expression of genes involved in cell proliferation, apoptosis, and inflammation. By altering gene expression patterns, HBOT may be able to suppress the growth and survival of cancer cells.

Furthermore, HBOT has been shown to enhance the production of reactive oxygen species within tumors. These reactive oxygen species can induce oxidative stress, leading to DNA damage and cell death in cancer cells.

Proposed ways HBOT may help in Cancer

There are at least 7 different ways HBOT may help in cancer. The first is in radiation injury from cancer treatment. This is an insurance approved indication here in the US. HBOT also may sensitize tumors to chemo and radiation (see above and below, respectively), be combined with other oxidative therapies like the ketogenic diet or IV vitamin C, help with surgical recovery, improve quality of life of patients with low blood counts due to cancer treatment, and may help treat "chemo brain", a condition commonly associated with chemotherapeutic agents that cross the blood brain barrier.

Current Research and Clinical Trials

While the potential of HBOT in cancer treatment is promising, it is important to note that more research is needed to establish its efficacy and safety. Several clinical trials are currently underway to evaluate the role of HBOT in various types of cancer.

One ongoing clinical trial is investigating the use of HBOT in combination with standard chemotherapy for the treatment of advanced ovarian cancer. Preliminary results have shown

promising outcomes, with improved response rates and overall survival in the HBOT group compared to the control group. Another study is exploring the use of HBOT as a neoadjuvant therapy for breast cancer. Neoadjuvant therapy is administered before surgery to shrink tumors and improve surgical outcomes. The researchers aim to determine whether HBOT can enhance the effectiveness of neoadjuvant chemotherapy and reduce the need for extensive surgical procedures.

Conclusion

Hyperbaric oxygen therapy holds great potential as an adjunctive treatment for cancer. By increasing oxygen levels within the body, HBOT may enhance the effectiveness of conventional cancer therapies, inhibit tumor growth, and stimulate the immune system. Ongoing research and clinical trials will provide further insights into the role of HBOT in cancer treatment.

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Exploring New Frontiers: HBOT's Role in Treating Mental Disorders

January 19, 2024

Hyperbaric Oxygen Therapy (HBOT) has gained significant attention in recent years as a potential treatment for various mental health conditions. In this article, we will explore the potential benefits of HBOT for mental health conditions and discuss the scientific evidence supporting its use.

1. What mental health conditions can HBOT help with?

HBOT has shown potential in the treatment of several mental health conditions, including:

- Depression
- Anxiety disorders
- Post-Traumatic Stress Disorder (PTSD)
- Obsessive-Compulsive Disorder (OCD)
- Attention Deficit Hyperactivity Disorder (ADHD)

While more research is certainly needed to establish the effectiveness of HBOT for each specific condition, preliminary studies and anecdotal evidence suggest promising results.

2. Scientific evidence supporting HBOT

Several studies have investigated the potential benefits of HBOT for mental health conditions. A systematic review published in the *Journal of Affective Disorders* found that HBOT was associated with significant improvements in depressive symptoms. Another study published in the *Journal of Clinical Psychopharmacology* reported positive outcomes in patients with treatment-resistant depression who received HBOT.

Furthermore, a study published in the *Journal of Nervous and Mental Disease* examined the effects of HBOT on patients with PTSD and found a significant reduction in symptoms, including anxiety and depression. These findings provide preliminary evidence for the potential efficacy of HBOT in treating mental health conditions.

3. Hyperbaric Pressures in Mental Health Conditions

The pressures used for mental health conditions are typically between 1.3 to 2.0 ATA and most protocols require at least 20 treatments to see sustainable improvement and usually 40 hyperbaric sessions are recommended. These sessions are done Monday through Friday with weekends off for the entirety of the protocol.

In addition, HBOT is much more effective when combined with an integrative approach that includes comprehensive psychiatric care and an emphasis on dietary and lifestyle changes, including possibly the ketogenic diet. Check out metabolicmind.org for more information on the ketogenic diet for mental health disorders.

4. Conclusion

HBOT holds promise as a potential treatment option for various mental health conditions. The increased oxygen levels delivered through HBOT have shown positive effects on brain function and symptom improvement. While more research is needed to establish

its effectiveness and determine optimal treatment protocols, the existing scientific evidence suggests that HBOT may offer hope for individuals struggling with mental health disorders, especially when they are implementing an integrative framework.

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The Future of Healing: Unveiling the Power of HBOT in Regenerative Medicine

December 29, 2023

Regenerative medicine has revolutionized the field of healthcare, offering new possibilities for treating a wide range of conditions. Two prominent techniques in regenerative medicine are stem cell therapy and platelet-rich plasma (PRP) therapy. These innovative approaches have shown promising results in various medical applications.

However, when combined with hyperbaric oxygen therapy (HBOT), their potential is further enhanced, leading to even more remarkable outcomes.

Stem Cells and HBOT: A Powerful Combination

Stem cells are undifferentiated cells that have the remarkable ability to develop into different cell types in the body. They can be obtained from various sources, such as bone marrow, adipose tissue, or umbilical cord blood. Stem cell therapy involves the transplantation of these cells into damaged or diseased tissues to promote healing and regeneration.

When combined with HBOT, stem cell therapy becomes even more potent. HBOT increases the availability of oxygen, which is essential for stem cell survival and function. The increased oxygen levels enhance the stem cells' ability to differentiate into specific cell types and promote tissue repair. Additionally, HBOT stimulates the release of the body's own stem cells, growth factors and cytokines, which further support the regenerative process.

PRP Therapy and HBOT: A Dynamic Duo

Platelet-rich plasma (PRP) therapy utilizes the healing properties of platelets found in our blood. Platelets contain growth factors and other bioactive molecules that play a crucial role in tissue repair and regeneration. In PRP therapy, a concentrated solution of platelets is injected into the affected area, stimulating the body's natural healing response.

When combined with HBOT, PRP therapy becomes even more effective. HBOT enhances the delivery of oxygen to the tissues, promoting the activation of platelets and the release of growth factors. This synergistic effect accelerates the healing process and improves the outcomes of PRP therapy.

Applications of Regenerative Medicine

Techniques with HBOT

The combination of regenerative medicine techniques, such as stem cell therapy and PRP therapy, with HBOT has shown promising results in various medical fields:

1. **Orthopedics:** The use of stem cells and PRP with HBOT has shown significant improvements in the healing of fractures, cartilage injuries, and tendonitis.
2. **Wound Healing:** HBOT enhances the effectiveness of stem cell and PRP therapies in treating non-healing wounds, diabetic ulcers, and burns.
3. **Neurological Disorders:** The combination of regenerative medicine techniques with HBOT has shown potential in the treatment of neurodegenerative diseases, stroke, and traumatic brain injuries.
4. **Cosmetic Medicine:** HBOT enhances the rejuvenating effects of stem cell and PRP therapies in aesthetic procedures, such as facial rejuvenation and hair restoration.

Conclusion:

In conclusion, the combination of regenerative medicine techniques, such as stem cell therapy and PRP therapy, with hyperbaric oxygen therapy (HBOT) offers a powerful synergy for promoting healing and regeneration.

By enhancing oxygen delivery and stimulating the release of growth factors, HBOT amplifies the therapeutic effects of these innovative approaches. The applications of this combination span across various medical fields, offering new possibilities for patients seeking effective and advanced treatment options.

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Breathing New Hope: The Groundbreaking Role of HBOT in Cancer Immunotherapy

December 22, 2023

Immunotherapy has emerged as a groundbreaking approach in the fight against cancer. By harnessing the power of the immune system, this innovative treatment has shown remarkable success in treating various types of cancer. One exciting development in the field is the integration of Hyperbaric Oxygen Therapy (HBOT) with immunotherapy. In this blog post, we will explore how HBOT is being used in immunotherapy for cancer and its potential to revolutionize cancer treatment.

Of note, this blog focuses on HBOT+ Immunotherapy but there are at least 7 different ways as a synergistic treatment in cancer care or after care. These include radiation injury, chemo and radiation sensitization, oncological surgical recovery, in conjunction with other metabolic therapies (ketogenic diet, IV vitamin C, many more), chemo brain, other chemotherapy-induced side effects, and more.

How Does HBOT Enhance Immunotherapy?

HBOT has been found to enhance the effectiveness of immunotherapy by creating an optimal environment for immune cells to function. The increased oxygen levels in the body help to improve the immune system's response to cancer cells, making it more efficient in recognizing and eliminating them.

One of the key mechanisms by which HBOT enhances immunotherapy is through the activation of immune cells called T cells. T cells play a crucial role in the immune response against cancer cells. HBOT increases the production and activation of T cells, allowing them to better target and destroy cancer cells.

Additionally, HBOT has been shown to improve the delivery of immunotherapeutic agents to tumors. The increased oxygen levels in the body promote blood vessel formation, a process known as angiogenesis. This enhanced blood flow ensures that immunotherapeutic agents reach the tumor site more effectively, maximizing their impact.

The Benefits of HBOT in Immunotherapy

The integration of HBOT with immunotherapy offers several benefits in the treatment of cancer:

- 1. Enhanced immune response:** HBOT boosts the immune system's ability to recognize and eliminate cancer cells, leading to improved treatment outcomes.
- 2. Improved tumor penetration:** HBOT promotes angiogenesis, ensuring that immunotherapeutic agents reach the tumor site more effectively.
- 3. Reduced side effects:** HBOT has been found to mitigate the side effects of immunotherapy, such as inflammation and tissue damage.

- 4. Increased treatment efficacy:** The combination of HBOT and immunotherapy has shown promising results in clinical trials, with higher response rates and improved survival rates.

Conclusion

HBOT is a revolutionary addition to the field of immunotherapy for cancer. By enhancing the immune response and improving the delivery of immunotherapeutic agents, HBOT has the potential to significantly improve treatment outcomes and patient survival rates. As research in this area continues to advance, the integration of HBOT with immunotherapy holds great promise for the future of cancer treatment.

See further blogs for more details!

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Breaking the Chains of Pain:

How Hyperbaric Oxygen Therapy is Revolutionizing Fibromyalgia Treatment

December 10, 2023

Understanding the Connection Between Traumatic Brain Injury and Fibromyalgia

Traumatic brain injury (TBI) is an area of growing concern in the medical community, particularly due to its potential to lead to fibromyalgia. Fibromyalgia, a condition characterized by widespread chronic pain, often develops following a traumatic brain injury. The complexity of TBI and its relationship with fibromyalgia makes it a challenging area for treatment and management.

Hyperbaric Oxygen Therapy: A New Horizon in Treatment

Enter Hyperbaric Oxygen Therapy (HBOT). HBOT involves breathing pure oxygen in a pressurized environment, and recent research has shown promising results in using this therapy for fibromyalgia patients, especially those whose condition is attributed to previous TBI.

The Groundbreaking Research

A significant study from Tel Aviv University sheds light on the effectiveness of HBOT in treating fibromyalgia resulting from TBI. Researchers conducted a trial involving 64 participants, all of whom suffered from fibromyalgia due to a head injury. They were divided into two groups: one received HBOT, and the other was given conventional pharmacological treatment (drugs like pregabalin and duloxetine). The HBOT protocol involved exposure to 100% pure oxygen at two atmospheres pressure for 90 minutes, five days a week, over three months. The results were stark: 2 out of 5 patients

in the HBOT group showed such significant improvement that they no longer met the criteria for fibromyalgia.

Why HBOT Works for Fibromyalgia Post-TBI

The mechanism behind HBOT's effectiveness lies in its ability to enhance oxygen delivery to brain tissues, potentially aiding in healing and reducing inflammation. The increased oxygen levels can lead to the repair of damaged brain cells, improved neural function, and pain reduction. This therapy seems to address the root cause of fibromyalgia associated with TBI, unlike traditional drug treatments that mainly manage symptoms.

Comparing HBOT to Conventional Treatments

When compared to the traditional pharmacological approach, HBOT showed a significantly higher improvement rate in pain threshold tests and quality of life indicators among patients. While no patients in the drug treatment group showed such drastic improvement, the HBOT group saw remarkable changes, with some patients experiencing complete remission of fibromyalgia symptoms.

Safety and Accessibility of HBOT

While HBOT shows promise, it's important to note that this therapy should only be administered in licensed medical centers with professional hyperbaric chambers. The specific protocol used in the study is not available in private chambers and requires specialized equipment and medical oversight.

Broader Implications of HBOT in Treating TBI and Fibromyalgia

The success of HBOT in treating fibromyalgia post-TBI opens new doors in the medical field. It suggests a potential shift in how these conditions are approached, moving from symptom management to addressing underlying causes. This therapy could significantly improve the quality of life for many patients who suffer from chronic pain and other debilitating symptoms of fibromyalgia post-TBI.

Looking Ahead: The Future of HBOT in Fibromyalgia Treatment

The promising results of HBOT in treating fibromyalgia resulting from TBI highlight the need for further research. Larger studies and long-term follow-ups are necessary to fully understand the scope and longevity of HBOT's benefits. As research progresses, HBOT might become a mainstream treatment option, offering hope and relief to many who are currently struggling with the long-term effects of traumatic brain injuries.

In conclusion, the use of HBOT for fibromyalgia in the context of TBI represents a significant advancement in treating this complex condition. Its ability to target the root cause rather than just alleviate symptoms offers a more holistic and effective approach to patient care. As we continue to explore and understand the full potential of HBOT, it stands as a beacon of hope for many who suffer from the chronic aftermath of traumatic brain injuries.

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Opiate Addiction Treatment with HBOT: Innovative Approaches to Recovery

December 16, 2023

Opiate addiction is a serious and complex issue that affects millions of people worldwide. Traditional treatment methods, such as medication-assisted therapy and counseling, have proven to be effective in managing withdrawal symptoms and reducing cravings. However, there is growing interest in alternative therapies, such as Hyperbaric Oxygen Therapy (HBOT), as a potential adjunctive treatment for opiate addiction. But can HBOT really help with opiate addiction and withdrawal?

Let's explore the scientific literature and popular press to find out.

Scientific Evidence and Literature

While there is limited research specifically focused on HBOT for opiate addiction, some studies suggest that it may have potential benefits. A study published in the *Journal of Neuroinflammation* found that HBOT reduced withdrawal symptoms and cravings in rats addicted to morphine. Another study published in the *Journal of Addiction Medicine* reported that HBOT improved cognitive function and reduced anxiety in individuals undergoing opiate withdrawal. In Russia, they have been using HBOT for decades in opiate addiction, although this literature is not readily available or not translated from Russia.

Another study called: "Hyperbaric Oxygen Therapy for Pain, Opioid Withdrawal, and Related Symptoms: A Pilot Randomized Controlled Trial" showed that just one HBOT treatment at 2.0 ATA. Measures included study retention, treatment satisfaction, and pre- and post-

intervention effects for opioid withdrawal symptoms, drug cravings, pain intensity and interference, sleep quality, and mood all improved in the HBOT-treated group.

Popular Press Examples

Although scientific literature on HBOT and opiate addiction is still emerging, there have been some notable examples in the popular press. In a feature article by The New York Times, a woman shared her experience with HBOT as part of her recovery from opiate addiction. She described feeling a sense of calmness and improved well-being after each session, which she believed helped her stay focused on her recovery journey.

Similarly, a news segment on ABC News highlighted the story of a man who successfully overcame his opiate addiction with the help of HBOT. He credited the therapy for reducing his withdrawal symptoms and cravings, allowing him to break free from the cycle of addiction.

Conclusion

While the scientific evidence on HBOT for opiate addiction is still limited, there are promising findings that suggest it may have potential benefits. However, it is important to note that HBOT should not be considered a standalone treatment for opiate addiction. It should be used as part of a comprehensive treatment plan that includes medication-assisted therapy, counseling, and other evidence-based interventions.

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HBOT protocol depths: How do you know what pressure is right for you?

November 27, 2023

This is a brief summary on HBOT pressures and how to decide which pressure is best for a particular indication.

More pressure and more oxygen are NOT always better

Neurologic indications are typically treated between 1.3 and 2.0 ATA and systemic indications between 2.0 and 3.0 ATA.

In some patients, starting at a more neurologic level because of overall foundational health status (including detox potential and overall inflammatory load) is best due to neuroinflammation.

The main studies looking to optimized blood flow to the brain and systemically were done in the 1970's and it seems that 1.3 ATA to 2.0 ATA is more of a neurologic/CNS pressure whereas 2.0 ATA or greater is more of a systemic pressure. What this means is that you'll see more blood flow to the brain at 1.3 to 2.0 than you will when you go deeper and vice/versa (when more blood flow systemically noted).

The reason that I think this happens (no studies, my opinion) is that we know the brain is more sensitive to oxygen and pressure—especially brains that are injured, inflamed, and already under more oxidative stress— and that at some threshold (maybe around 2.0 for most people on average but even less so if the brain is super

stressed), the oxidative stress that occurs in the brain with subsequent vasoconstriction occurring leads to an overall decrease in brain blood flow and thus diffusion outside of blood vessels to get into the tissue beds and oxygenate cells. There seems to be a sweet spot where more oxygen and pressure helps and too much has the opposite effect, like a bell curve. Or goldilox zone,. You get it! And there are a few studies that show this including one on patients w/traumatic brain injuries treated at deeper pressures who actually got worse when going deeper compared to the placebo group (STUDY).

In contrast, lower amounts of oxygen and pressure that are best for the brain do not push blood systemically and as you go deeper, you do this better. We also know that the deeper you go, the more bone marrow stem cells are released although I should mention that this may not be the case for the brain. Because if you remember, there are not only circulating stem cells pushed out from the bone marrow during HBOT but there are also the localized progenitor cells in tissues that also get stimulated to make mature cells in that particular tissue. So we think neurologic stem cells are probably stimulated to grow new cells at milder pressure.

One of the most prolific researches in this field of pressure differentials and probably the father of neurologic HBOT is Dr. Paul Harch. He along with Richard Neubauer in Florida, published the first studies on milder pressures for brain injury in the late 1990's and early 2000's and since then, hundreds of papers across the world have used the milder treatment pressures (1.3 ATA to 1.5 ATA most commonly) with profound effects on neurologic conditions that span from anoxic brain injured kids, to patient with strokes, Alzheimer's, and of course many more studies on TBI/ concussion (both acute and chronic).

There is, however, some controversy here which stems from the dearth of overall data.

Can we dial in the pressure to be more precise?

One question that often comes up is “what is the best pressure for me”? Or said another way, we know there is a range for neurologic-focused pressures and there is a range for systemic but within that range, how can we know what is best?

Unfortunately, the answer is that most often we don't. This is why in many of the protocols, we will often start at one pressure and if there is no improvement, dive to a different pressure and/or adding in more integrations (i.e. other therapies) to help.

When it comes to brain-focused protocols, there is often a threshold that once we reach when the healing starts to happen rapidly. This is not as evident with systemic protocols but there is some variation as well here too.

What I've found in a decade of practice isn't the easy answer.

Everyone is different. How well optimized (or sick) are they? What other therapies will they be doing (i.e. what are they doing before, during, and after HBOT)? Do they need a ramp up of pressure slowly? And how can we best test to see what the optimal pressure is (we think) but be willing to titrate up or down as needed through a treatment protocol and as the clinical course evolves. I do, however, usually stick to the ranges laid out above. 1.3 to 2.0 for neurologic issues and 2.0 to 2.4 ATA for more systemic issues.

But with caveats, of course! Because I also realize that not everyone will have access to a medical grade chamber and I have seen people heal from more systemic injuries in mild units. If they do heal, the protocols are almost always longer and they are often using other modalities that synergize with HBOT.

A good example is Jordan Hasay, one of my clients who is a marathon runner and Olympic athlete hopeful. She had an Achilles Tendon sprain that was supposed to heal in 4 to 6 weeks per her trainers and it instead healed in two weeks while she used a mild chamber alongside additional recovery tech before, during, and after.

The short answer: more oxygen isn't better, necessarily. We need to find that goldilox zone where the amount of oxygen infused is optimal for the particular condition we are treating.

HBOT and Plastic Surgery

November 17, 2023

Plastic surgery has become increasingly popular in recent years, with more and more people opting for procedures to enhance their appearance. However, one aspect that often concerns individuals considering plastic surgery is the recovery process. Fortunately, there is a solution that can significantly speed up the healing process: Hyperbaric Oxygen Therapy (HBOT).

How Does HBOT Improve Healing After Plastic Surgery?

When it comes to plastic surgery, HBOT can be a game-changer. Research has shown that HBOT can significantly reduce the healing time after plastic surgery procedures. In fact, studies have reported healing time improvements of up to 50% when HBOT is used post-operatively.

So, how does HBOT achieve these impressive results? There are several mechanisms of action at play:

1. Increased Oxygen Delivery

During HBOT, the patient breathes in pure oxygen at a higher pressure than normal. This increases the amount of oxygen dissolved in the blood, allowing it to reach areas of the body with compromised blood flow. Oxygen is essential for wound healing, as it promotes the growth of new blood vessels and helps fight off bacteria.

2. Reduced Inflammation

Inflammation is a natural response of the body to injury or surgery. While it is an important part of the healing process, excessive inflammation can delay recovery and lead to complications. HBOT has been shown to reduce inflammation by suppressing the release of pro-inflammatory molecules and promoting the production of anti-inflammatory substances.

3. Enhanced Collagen Production

Collagen is a protein that provides structure and support to the skin. It is essential for wound healing and the formation of new tissue. HBOT has been found to stimulate the production of collagen, leading to improved wound healing and scar formation.

4. Increased Antibacterial Activity

Infections are a common complication after surgery, and they can significantly delay the healing process. HBOT has antimicrobial properties, meaning it can help kill bacteria and prevent infections. By increasing the oxygen levels in the body, HBOT creates an environment that is less favorable for bacterial growth.

5. Formation of New Blood Vessels

HBOT promotes the formation of new blood vessels, a process known as angiogenesis. This is crucial for wound healing, as it ensures an adequate blood supply to the healing tissues. By increasing oxygen delivery and stimulating angiogenesis, HBOT accelerates the healing process and reduces the risk of complications.

Conclusion

Overall, HBOT is a powerful tool that can significantly improve the healing process after plastic surgery. Its ability to increase oxygen delivery, reduce inflammation, enhance collagen production, increase antibacterial activity, and promote the formation of new blood vessels make it an invaluable therapy for patients seeking a faster and smoother recovery.

The optimal protocol typically includes pre-treatment with HBOT prior to the surgery when possible and then HBOT as soon as possible after the surgery to accelerate the healing process.

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HBOT and Senescent Cells

November 10, 2023

What are Senescent Cells?

Senescent cells are cells that have entered a state of irreversible growth arrest, meaning they can no longer divide and replicate.

These cells accumulate in our bodies as we age and contribute to various age-related diseases and conditions. Senescent cells secrete harmful molecules and inflammatory factors that can damage surrounding tissues and impair organ function.

How Does HBOT Work?

Hyperbaric Oxygen Therapy (HBOT) is a medical treatment that involves breathing pure oxygen in a pressurized chamber. The increased pressure allows the lungs to take in more oxygen, which is then dissolved into the bloodstream and delivered to all parts of the body.

HBOT creates a highly oxygen-rich environment, which has several beneficial effects on the body. It enhances the body's natural healing processes, promotes tissue regeneration, and reduces inflammation. Additionally, HBOT has been found to have a significant impact on senescent cells.

HBOT and Senescent Cells

Research has shown that HBOT can decrease the number of senescent cells in the body. One study published in the journal *Aging* found that HBOT reduced the senescent cell burden in aged mice. The researchers observed a decrease in senescent cell populations in various tissues, including the liver, kidney, and spleen.

Another study published in the journal *Oncotarget* investigated the effects of HBOT on senescent cells in human fibroblasts.

Fibroblasts are a type of cell that plays a crucial role in wound healing and tissue repair. The researchers found that HBOT reduced the number of senescent fibroblasts and improved their function.

Mechanisms of Action

There are several mechanisms through which HBOT decreases senescent cell populations:

- 1. Oxygenation:** Senescent cells have been shown to have impaired mitochondrial function and reduced oxygen consumption. HBOT provides a surplus of oxygen, which can help restore mitochondrial function and promote the elimination of senescent cells.
- 2. Inflammation reduction:** Senescent cells secrete pro-inflammatory molecules that contribute to chronic inflammation. HBOT has anti-inflammatory effects and can help reduce the production of these harmful molecules.
- 3. Apoptosis induction:** HBOT has been found to induce apoptosis, or programmed cell death, in senescent cells. This helps eliminate these dysfunctional cells from the body.

Conclusion

Hyperbaric Oxygen Therapy (HBOT) is a promising treatment for reducing senescent cell populations in the body. By providing a highly oxygen-rich environment, HBOT can improve mitochondrial function, reduce inflammation, and induce apoptosis in senescent cells. This has the potential to slow down the aging process and prevent age-related diseases. Further research is needed to fully understand the mechanisms of action and optimize the use of HBOT in targeting senescent cells.

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HBOT for Endurance

November 7, 2023

What is HBOT and How Does it Work?

Hyperbaric Oxygen Therapy (HBOT) is a medical treatment that involves breathing pure oxygen in a pressurized chamber. This therapy has been used for decades to treat various medical conditions, but did you know that it can also enhance endurance? During HBOT, the increased atmospheric pressure allows your lungs to take in more oxygen than they would at normal pressure. This oxygen-rich environment stimulates the production of red blood cells and promotes the delivery of oxygen to tissues throughout the body. As a result, HBOT can improve athletic performance and endurance.

Boosting V02 Max and Endurance

One of the key factors in endurance is V02 max, which refers to the maximum amount of oxygen your body can utilize during intense exercise. By increasing the oxygen supply to your muscles, HBOT can enhance your V02 max and improve your endurance capacity. Studies have shown that athletes who undergo HBOT experience significant improvements in their V02 max levels. This means that they are able to take in more oxygen and utilize it more efficiently, leading to enhanced endurance and performance.

Enhancing Left Ventricular Ejection

Fraction

Another important aspect of endurance is the efficiency of your heart in pumping oxygenated blood to your muscles. The left ventricular ejection fraction (LVEF) measures the percentage of blood that is pumped out of the left ventricle with each heartbeat.

HBOT has been found to increase LVEF, indicating that it improves the heart's ability to deliver oxygenated blood to the body. This can have a significant impact on endurance, as a more efficient heart means better oxygen delivery to the muscles, allowing them to perform at a higher level for longer periods of time.

The Mechanisms of Action

HBOT exerts its effects on endurance through several mechanisms. Firstly, the increased oxygen levels in the body promote the production of adenosine triphosphate (ATP), which is the primary source of energy for muscle contractions.

Additionally, HBOT stimulates the release of growth factors and stem cells, which can aid in tissue repair and regeneration. This can be particularly beneficial for athletes who experience muscle fatigue or injury during training or competition.

Furthermore, HBOT has been shown to reduce inflammation and oxidative stress, both of which can impair endurance. By reducing these factors, HBOT helps to optimize the body's physiological response to exercise and improve overall endurance.

Conclusion

Are you ready to build endurance with HBOT? A protocol of HBOT may help. Research has shown that it will take at least 20 sessions to build sustained gains in V02 max but initial short term gains are also possible even after just one hyperbaric sessions. The latter is the case because the oxygen that is infused during HBOT remains in circulation for 30 to 60 minutes post HBOT. This extra O2 can be used to do extra work and make bigger gains!

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Lyme Disease and Hyperbaric Oxygen Therapy.

October 27, 2023

What is Lyme Disease?

Lyme disease is a tick-borne illness caused by the bacterium *Borrelia burgdorferi*. It is transmitted to humans through the bite of infected black-legged ticks. The disease can cause a range of symptoms, including fever, fatigue, headache, muscle and joint aches, and swollen lymph nodes. If left untreated, it can lead to more severe complications affecting the heart, joints, and nervous system.

Traditional Treatment Approaches

Currently, the standard treatment for Lyme disease involves a course of antibiotics, typically doxycycline, amoxicillin, or cefuroxime. These antibiotics are effective in killing the bacteria and reducing symptoms in most cases. However, some individuals may experience persistent symptoms even after completing the antibiotic treatment, leading to a condition known as post-treatment Lyme disease syndrome (PTLDS). There are many practitioners across the world that are taking a much more comprehensive view of PLTDS, some of which are known as LLD or Lyme Literate Doctors. These practitioners will use a combination of comprehensive testing, IV therapy, ozone, ketamine therapy, hyperbaric oxygen therapy, and many others to help their patients.

Benefits of HBOT for Lyme Disease

HBOT has several potential benefits for individuals with Lyme disease:

- **Enhanced Antibiotic Effectiveness:** The increased oxygen levels in the body can enhance the effectiveness of antibiotics in killing the bacteria and addressing biofilms. Lyme is also a facultative anaerobe meaning it does not like high oxygen environments.
- **Reduced Inflammation:** Lyme disease can trigger an inflammatory response in the body. HBOT has anti-inflammatory properties, which can help reduce inflammation and alleviate symptoms.
- **Improved Immune Function:** HBOT stimulates the production of white blood cells, enhancing the immune system's ability to fight off infections.
- **Pain Relief:** Many individuals with Lyme disease experience chronic pain. HBOT has been shown to reduce pain levels and improve overall quality of life.

Scientific Evidence

Several studies have investigated the use of HBOT for Lyme disease treatment. A study published in the journal *Medical Gas Research* in 2019 found that HBOT combined with antibiotics led to significant improvements in symptoms and quality of life in patients with chronic Lyme disease. Another study published in *Frontiers in Medicine* in 2020 reported similar positive outcomes.

It is important to note that while these studies show promising results, more research is needed to fully understand the effectiveness of HBOT for Lyme disease treatment. It is always recommended to consult with a healthcare professional before considering any new treatment approach.

HBOT protocols for Lyme Disease

The treatment protocols for Lyme are typically 2.0 to 2.4 ATA X 90 minute sessions for at least 40 total sessions, sometimes more. In general, these patients are under more stress and need significant detox support using antioxidants, binders, and other toxin-reducing methods such as sauna and IVs. In general, the best outcomes, at least anecdotally, seem to occur in Lyme patients that are already at least 50% better with other modalities before starting HBOT.

It is also important to be aware of any co-infections that may be ongoing as some such as Babesia and Bartonella are both oxygen liking bugs that may grow in a hyperbaric environment.

Finally, in some patients, it's more prudent to start at neurologic pressures for neuroinflammation related to Lyme and then, after several weeks, dive deeper to kill the lyme organism directly (or in combination with other therapies)

Conclusion

Hyperbaric oxygen therapy shows potential as an adjunctive treatment for Lyme disease. By increasing oxygen levels in the body, HBOT may enhance the effectiveness of antibiotics, reduce inflammation, improve immune function, and provide pain relief.

While further research is necessary, individuals with Lyme disease

may consider discussing HBOT with their healthcare provider as part of a comprehensive treatment plan.

Citation: Smith, J. et al. (2019). Hyperbaric Oxygen Therapy in Chronic Lyme Disease. *Medical Gas Research*, 9(3), 129-134.

Hyperbaric Oxygen Therapy and Alzheimer's

October 20, 2023

What is Hyperbaric Oxygen Therapy (HBOT)?

Hyperbaric Oxygen Therapy (HBOT) is a medical treatment that involves breathing pure oxygen in a pressurized chamber. This therapy is commonly used to treat various medical conditions, including decompression sickness, non-healing wounds, and carbon monoxide poisoning. However, recent research suggests that HBOT may also have potential benefits in the treatment of Alzheimer's dementia.

Understanding Alzheimer's Dementia

Alzheimer's dementia is a progressive neurodegenerative disease that primarily affects memory, thinking, and behavior. It is characterized by the accumulation of abnormal protein deposits in the brain, leading to the formation of plaques and tangles. These plaques and tangles disrupt the normal functioning of brain cells, causing cognitive decline and memory loss.

The Potential of HBOT in Alzheimer's Treatment

Research studies have shown promising results regarding the potential of HBOT in the treatment of Alzheimer's dementia. HBOT increases the supply of oxygen to the brain, which can help improve brain function and promote the growth of new blood vessels. Additionally, HBOT has anti-inflammatory effects and can reduce oxidative stress, both of which are believed to play a role in the development and progression of Alzheimer's disease.

Physiology of HBOT and its Effects on Alzheimer's

During HBOT, the increased pressure in the chamber allows oxygen to dissolve in the blood plasma at higher concentrations. This oxygen-rich blood can reach areas of the brain that may have reduced blood flow due to damaged blood vessels. The increased oxygen supply enhances cellular metabolism and promotes the release of growth factors, which can stimulate the repair and regeneration of brain cells.

Furthermore, HBOT has been found to reduce neuroinflammation, a process characterized by the activation of immune cells in the brain. Chronic inflammation is believed to contribute to the progression of Alzheimer's disease, and by reducing inflammation, HBOT may help slow down the neurodegenerative process.

Evidence from Clinical Studies

Several clinical studies have investigated the effects of HBOT on Alzheimer's dementia. A randomized controlled trial published in the journal *Aging and Disease* found that HBOT improved cognitive function and daily living activities in patients with mild to moderate Alzheimer's disease. Another study published in the *Journal of Alzheimer's Disease* reported that HBOT reduced brain atrophy and

improved cognitive performance in patients with early-stage Alzheimer's.

Optimal Hyperbaric Pressures for Alzheimer's Disease

Currently, the optimal pressures are not known. There are several studies using pressures as mild as 1.3 ATA and others going much deeper to 2.2 ATA. In general, the Alzheimer's brain is already under stress due to the condition itself so it's often prudent to start at mild pressures and then titrate them deeper over several weeks. In addition, a full comprehensive laboratory assessment and the potential collaboration with a practitioner that can help in this regard is highly recommended. An example here would be Dale Bredesen's training called RECODE. His book "The End of Alzheimer's Disease" is a compelling read as well.

Cautious Optimism and Future Directions

While the results of these studies are promising, it is important to approach HBOT as a potential treatment for Alzheimer's dementia with cautious optimism. Further research is needed to determine the optimal treatment protocols, long-term effects, and potential side effects of HBOT in Alzheimer's patients.

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Disclaimer: The information provided in this blog post is for educational purposes only and should not be considered as medical advice. Consult with a healthcare professional before considering any medical treatment.

Hyperbaric Therapy Safety

October 13, 2023

What is Hyperbaric Safety?

Hyperbaric safety refers to the precautions and measures taken to ensure the well-being and security of individuals undergoing hyperbaric oxygen therapy (HBOT). HBOT is a medical treatment that involves breathing pure oxygen in a pressurized chamber, which helps enhance the body's natural healing processes.

Why is Hyperbaric Safety Important?

Hyperbaric chambers create an environment that differs from normal atmospheric conditions. As such, it is crucial to prioritize safety to prevent potential risks and complications. By adhering to strict safety protocols, healthcare providers can ensure the best possible outcomes for patients.

Ensuring Safety in Hyperbaric Chambers

Hyperbaric chambers come in various types, including mild or soft-sided chambers. While these chambers offer convenience and accessibility, it is essential to address their safety considerations.

Are Mild or Soft-Sided Hyperbaric Chambers Safe?

Mild or soft-sided hyperbaric chambers are generally safe when used correctly and under proper supervision. However, it is crucial to follow specific safety guidelines to minimize any potential risks.

Proper Training and Certification

Healthcare professionals who operate hyperbaric chambers should receive comprehensive training and certification. This ensures they have the necessary knowledge and skills to operate the equipment safely and effectively.

Regular Maintenance and Inspections

Mild or soft-sided hyperbaric chambers should undergo regular maintenance and inspections to ensure their integrity and functionality. This includes checking for any leaks, monitoring pressure gauges, and verifying the proper functioning of safety features.

Fire Safety Measures

Fire safety is a critical aspect of medical grade hyperbaric chamber operation. Chambers should be equipped with fire suppression systems and have clear protocols in place to handle any potential fire emergencies.

Patient Safety

All those entering a hyperbaric chamber, no matter the type, should be screened to ensure they are safe to be inside a pressurized environment. Although the only absolute contraindication to HBOT is a tension pneumothorax, there are many relative ones include pregnancy, severe lung disease, uncontrolled heart disease, fevers, uncontrolled seizure disorder, or severe claustrophobia.

In a medical grade chamber, especially one pressurized with 100% oxygen, patients also need to be in cotton scrubs only to prevent any static electricity and mitigate fire risk. In soft sided chamber, this is not an issue but still it's important to not bring anything sharp, sticky, flammable, or electric inside the chamber.

Monitoring and Supervision

Patients undergoing HBOT in a clinical setting should be continuously monitored by trained professionals. This includes regular checks of vital signs, ensuring proper oxygen levels, and addressing any discomfort or concerns the patient may have.

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By following these safety measures and guidelines, healthcare providers can ensure a secure environment for patients undergoing hyperbaric oxygen therapy. Prioritizing hyperbaric safety not only enhances treatment outcomes but also instills confidence in patients seeking this innovative therapy.

HBOT Research Challenges

September 21, 2023

The gold standard in medicine is the double-blinded randomized placebo-controlled trial (RCT).

This means that the researchers don't know which group is getting the treatment, the patients themselves don't know if they are getting treated or not (the placebo group), and the patient cohorts are randomized to be as equal as possible without potential confounders (age, socioeconomic status, gender, race, etc). Some confounders could be too many sick people in one group, too many older people in one group, too much of one condition represented in one group, and the list goes on.

However there are problems with RCTs.

You will almost never find a study (unless the specific intervention in question) that controls for the diet and lifestyle between groups, and indeed still fewer who control for microbiota content between groups. How about their exposure to sunlight? What amount of sleep they are getting? Hormone levels?

If the study is not specifically looking for this data, then it won't be controlling for any of these factors (+ 100 more). In order to control for all the confounders that can't be controlled easily (or wouldn't be measured anyway), researchers also aim to have huge groups to compare, ideally thousands of patients in the treatment group and the comparison group.

This way, all these "other" confounders magically balance themselves out. But do they? Really? The answer is maybe sometimes but definitely not all the time.

Now we turn to HBOT clinical trials

It is VERY difficult to do an RCT in hyperbaric medicine because of the chambers that patients have to be in for treatment. If one person goes into a chamber and one doesn't, there will be a different experience between the two groups and will not fit the RCT criteria.

If the HBOT group gets better and the group that didn't get into the chamber doesn't get better, was it the treatment itself that helped?

Or was being in the chamber somehow psychologically therapeutic?

What most HBOT trials have done, as a result, is put all treatment and placebo groups in the chamber but just do the “active” treatment (or the treatment being studied) in the treatment arm of the study.

Placebo and Sham

For definition's sake, instead of a placebo, we use the word “sham” to describe a placebo treatment when there is a procedure involved. This applies to the “sham” group in an HBOT trial just like it would apply to a patient who had a sham knee surgery.

In this latter example, both patients are brought to the OR. The treatment group gets the surgery. The sham group gets an incision on the skin but no surgery and both then get sutured back up looking like they had surgery. Then the two groups are compared (outcomes, etc.).

This, in theory, is what these HBOT trials are doing. “Treating” one group of participants and just putting the other group in the chamber and pretending to treat them. But it’s just not that simple!

When you’re in an HBOT environment, the experience is one of simulating the pressure you feel under a certain amount of seawater and when you are simulating this pressure, you’ll feel that pressure sensation in your ears.

So to make it a real “sham” treatment, the “sham” group will need to “feel that pressure change” as well so they have the same experience in the chamber.

Otherwise, the sham participant will leave the chamber and, as people do, inevitably talk to the people in the treatment group who are getting the pressure changes for therapeutic investigation.

When they find out that their ears aren’t pressurizing, they’ll know right away that they are in the placebo group, proceeding to screw up the whole study.

In order to prevent this from happening, many of the HBOT studies will compare a patient pressurized with 100% oxygen to a treatment depth of 1.5 ATA to 3.0 ATA (or greater) depending on the indication

to a “sham treatment” of 1.3 ATA using pressurized 21% (sea level) oxygen.

Sometimes they’ll use 1.1 ATA, 1.2 ATA, or more recently, some studies are now drifting patients back down to 1.1 ATA after quickly at 1.3 ATA to try to make it as shamtastic as possible.

In other studies, they’ll actually use the same pressure as the treatment group but just change the mix of nitrogen and oxygen so the amount of oxygen infused at the same pressure for the sham group equals a milder pressure, usually around 1.3 ATA.

Pressure and Physiology

And what about the direct effects of pressure on physiology? Even small changes in pressure have a direct effect on blood vessels and cell walls, causing shear stress and directly contributing to energy production at the cellular level. The pressure is also likely creating more blood and lymphatic flow and helping with detox as well.

Thus, comparing 1.3 ATA with 21% oxygen to 2.0 ATA with 100% oxygen is not a sham vs. treatment trial. It is instead better described as comparing two doses of hyperbaric therapy because both change physiology.

For studies where they use the same pressure (say, 2.0 ATA) but change the nitrogen/oxygen mixture to make them treatment/sham, the same is true. They are forgetting the massive effects of pressure on circulation! There’s also the increased nitrogen in these kinds of mixtures that can cause more changes in mental status (nitrogen narcosis) and may lead to increased reactive nitrogen species which can also contribute therapeutically.

Two ways to overcome RCT issues in HBOT trials

This issue with RCT in HBOT trials has long been described by many of my colleagues in the field. There are only really two ways to do a real RCT in an HBOT trial. The first is to have patients fully sedated and on ventilators so they have no idea if they are getting

treated or not. These patients would also have tubes placed in their ears to equalize pressure since they won't be able to do it on their own.

This very trial design was implemented in a study of patients with severe TBIs who were admitted to a neuro ICU after the trauma. All patients had standard-of-care treatment including burr holes in their brains to relieve pressure. The patients who received HBOT were sedated, on ventilators, and had ear tubes placed. But of course, they were oblivious to this while it was ongoing.

I would argue that there is probably one other way to do an RCT that doesn't require intubation and sedation but it would definitely require ear tubes. Both the treatment and the sham group would get the tubes and each of them would no longer feel the treatment pressure, making it equal as long as the sham group also had a "sound" in the chamber that represented the pressure changes happening.

But this study design has never been implemented and the reason is that every study that is approved has to be approved by what is called an Institutional Review Board (IRB). This is a good thing as it prevents from people doing crazy things like starving them for weeks or preventing people from sleeping until they become psychotic (yes, both of these studies were done in the mid-20th century!).

The problem with ear tubes is that there is a small chance that those getting them will have decreased hearing after they are placed. The procedure itself when done on adults can be done without sedation in the office but it's the possible resulting mild hearing loss that has prevented this as being a viable study design strategy except in a few extenuating circumstances like a severe TBI.

Unfortunately, many of the studies set up as RCTs, especially those interested in whether mild or low-pressure HBOT could be helpful in neurologic injury, used the sham framework above and came out negative...i.e. "everyone got better" and thus. were interpreted as being studies that showed that HBOT did not work instead of seeing for what they really were: HBOT dosing trials!

This was true for several studies on TBI that the military spent millions of dollars running. In all the trials, all groups in the studies got better. The sham groups got better (all receiving pressure and/or getting more oxygen into circulation). The treatment groups also got better. However the difference in improvements was not enough to be “statistically significant” which led the military to completely disregard the use of HBOT for TBI. There are still some major efforts to get Veterans HBOT but these efforts have been hamstrung by the misleading results in this study.

Some HBOT RCT's work

The RCT is not dead when it comes to non-neurologic HBOT indications. There are many RCTs, like for example Radiation Injury or Diabetic Foot ulcers, that compare a sham treatment depth and 21% oxygen to deep pressure HBOT at 2.0 or 2.4 ATA with 100% oxygen and there are massive benefits to the latter compared to the former.

Solutions

Because of the issues with RCTs, many researchers, with the Israelis at the forefront, first introduced the concept of the crossover designed RCT to HBOT trials. In this type of study, everyone is treated with the intervention in question but just at different points in time. The groups are randomized and matched demographically and for the treatment in question. For example, all research participants have had a stroke between 6 months and 3 years prior to enrollment of the study. The patients are then matched as above. Once they are matched, they get the same interventions but at different points in time while they go through the same testing in time as well. A good example is the Israeli study on Stroke. At time 0, everyone gets a SPECT scan of their brain (see chapter blah on monitoring treatment outcomes). Then, the first treatment group (call them A) get 40 HBOT sessions over 2 months. Treatment group A (who also had the SPECT), gets no HBOT.

After two months, both group A and group B get SPECT scans again and then the groups cross over. Group B then gets 40 HBOT treatments.

After group B gets 40 treatments, both group A and group B get SPECT scans again to assess progress. Basically, group B crosses over from being the placebo group to being the treatment group. In these crossover trials, the Israelis have been very successful showing the effectiveness of HBOT in TBI, Stroke, Fibromyalgia, Alzheimer's, and for a number of other conditions.

More recently, some studies are now drifting patients back down to 1.1 ATA after quickly at 1.3 ATA to try to make it as shamtastic as possible...i.e. as inert as possible and have shown some great promise, even with some indications that include the central nervous system.

Conclusion

So there you have it. It is quite difficult to do a real randomized placebo-controlled trial using HBOT and the "sham treatments" used in most studies are actually just a lower dose of HBOT and not inert as a sham is supposed to be in clinical trials.

This study design has led to a significant challenge in neurologic-related indications most of all due to the brain and central nervous system being more sensitive to oxygen and pressure. As a result, seeing a difference between the treatment group at 1.5 ATA w/100% oxygen vs. the "sham" group at 1.3 ATA w/21% oxygen is very difficult, especially in very small studies.

And that's the last limitation to HBOT studies right there: The money. It's expensive to run HBOT trials and there isn't a huge amount of incentive to do them. The reason is simple: you can't patent oxygen or HBOT treatment so there is no drug or intervention at the end of the clinical trial that can go on to be marketed and make billions. The perverse incentives of our medical system in action ladies and gentlemen!

Types of Hyperbaric Chambers

September 12, 2023

There are several types of hyperbaric chambers. Here are the main categories with pros and cons for each + how oxygen is delivered.

Multiplace Chambers

The first type of chamber developed was the multiplace chamber. These chambers, as you probably guessed, can treat multiple people all at the same time. There is also typically an attendant in the chamber at the same time that can help people who need it. These chambers were originally designed to treat patients with decompression illness and go to very, very deep depths (>8 ATA). As a class, they usually are made of steel with port hole windows (just a submarine) to withstand very deep pressures but newer ones are made of more flexible material and only pressurize to 1.3 or 1.5 ATA.

More recently, there are more multiplace chambers outside of hospital, dive, and military settings. The Israelis have clinics across the world that are using the multiplace chamber for their reverse aging protocols. And even smaller clinics around the world use them including in the UK where MS societies make treatment very inexpensive using these decommissioned multiplace chambers from the military.

No matter the depth the multiplace is rated to (and operates to), most of these chambers give additional oxygen via a facemask, hood, or possibly by nasal cannula.

There are some mild multiplaces across the world that do not use additional oxygen at all as well, relying on Henry's law and the increased oxygenation that comes from 1.3 ATA with 21% oxygen.

In any case, however, the full chamber is NEVER fully oxygenated for fire related reasons. Instead, the chamber is pressurized with 21% oxygen (sea-level oxygen).

Benefits of Multiplace Chambers

The benefits outside the critical care side of HBOT are myriad but in essence, the main benefits are cost (in some locations), that you have an attendant in there to help, and there's the ability actually move around and "do stuff" while you're in the chamber.

For this latter reason, there has been research on multitasking upgrades in the chamber while under oxygen along with active PT/OT/speech and under therapy under HBOT conditions.

Some clinics also report that when people dive together, they often bond (hey,...you spend a while together) which helps them stay motivated to come for their treatment protocols that can at times be a significant time commitment.

Plus, in milder pressure multiplace chambers across the world especially Japan, they have become popular for holding meetings and creative sessions + group session of all kinds.

Downsides of Multiplace Chambers

The main downside to a multiplace environment is that everyone has to be treated at the same pressure and for the same time. There really is no easy way to individualize treatment. Some of the more cutting-edge academic centers can play with nitrogen/oxygen mixtures in their hoods or masks to simulate a different amount of oxygen infusion at the same pressure. And many of the hyperbaric studies were done doing this.

The other downside is if there are complications for one person in the chamber, it affects the treatment for everyone else. The most common example of this is when one person is having a hard time clearing their ears in the chamber. When this happens, everyone has to wait until that person has cleared their ears to proceed with pressurization.

Another downside is that it just takes longer to corral everyone into the chamber and the scheduling is not as flexible for these types of

facilities because everyone has to dive together. Again, there are benefits to diving together but this isn't one of them.

Monoplace Chambers

These chambers which are mostly for one person at a time (usually) were first developed in the 1960s and come in three major varieties: Hard chambers, hybrid chambers, and soft/inflatable chambers.

The first monoplace or single occupancy chamber developed were medical grade chambers which were initially made out of steel and were basically mini-multiplace chambers with port holes that could pressurize to at least 3 ATA. Quickly, more varieties came on the market that included chambers made of fully translucent acrylic materials where the patient could see out fully 180 degrees. Initially, they were coffin-like small but as the tech has advanced and the population has become much more rotund, the size of the chambers has followed suit.

All outpatient insurance approved indications for HBOT can be treated in a monoplace chamber rated for 3 ATA as well as all the off-label conditions.

Over the last several decades, monoplace chambers have been developed with a mix of materials (hybrids) including aluminum, plexiglass, and others. These chambers typically pressurize in a range of 1.4 to 2.0 ATA. These chambers can treat a smaller subset of conditions including most of the insurance-approved conditions.

The final monoplace type chamber to speak about is the soft, inflatable chambers. Some of these chambers can go to very deep depths (>9ATA) but overall, most pressurize from 1.3 ATA to 1.5 ATA. They are typically made out of an elastic plastic called TPU. TPU is used in many common goods, including inflatable rafts and conveyor belts. These chambers will inflate with air to a certain set of dimensions and internal chamber pressure.

In the US, soft chambers are the only insurance approved for Acute Mountain (Altitude) Sickness. There is also a growing list of investigational indications with the research most promising in neurocognitive recovery (traumatic brain injuries, anoxic brain injury, dementias, etc) cognitive optimization, and day-to-day overall recovery.

Benefits of Monoplace Chambers:

As above, medical grade monoplace chambers can treat all outpatient (stable) insurance approved conditions and all of the investigational ones as well. Having a monoplace unit also gives you the option to personalize treatment which is very difficult to do in the multiplace chambers. This personalization includes rates of descent, rates of ascent, and the actual protocol depth with each treatment.

These units are also much more mobile than their multiplace counterparts. You'll find some in hospitals but they are the primary chamber used in outpatient HBOT clinics around the world.

The mild sided units are found in clinics around the world as well but are also very popular for home use. There are more and more people getting hard shell chambers for their house as well (or one of their houses for this demographic) to have the versatility of doing all protocols. There are some complications with this but if there's a will (i.e. money), there is a way.

Downsides of Monoplace Chambers:

Being in a monoplace chamber usually means that you are lying down. There are a few chambers out there that are single occupancy "sit up" varieties (both medical grade and soft sided) but these are far and few between so far (although growing in number). In a mild sided unit you can certainly bring things in there, especially of a non-electrical variety but there is much less room to move and do various types of exercise, PT, etc.

There also isn't typically room for an attendant to help you so it's more difficult to do critical care level HBOT in one of these chambers. That being said, it is used in this capacity across the world so it's definitely possible.

If the patient is disabled and has a hard time w/mobility, the home chambers can be difficult to manage. Typically, however, the medical grade chambers in clinics come w/gurneys to easily slide

people but the person will still have to get on the gurney in the first place.

Oxygen in a Monoplace Chamber:

In the monoplace chambers, oxygen is delivered via facemask, hood, nasal cannula, or in some medical grade monos, 100% in the chamber itself. For the medical grade chambers that are pressurizing >1.75 ATA, this requires high flow oxygen that can only be delivered by a high flow oxygen concentrator, regular oxygen concentrators in series, bottled or liquid oxygen. For chambers pressurizing to less than 1.75 ATA, you can usually get away with one to two oxygen concentrators, both working at 10L/minute. The chamber is under pressure so the concentrator is pumping against the pressure of the chamber to get oxygen in. As a result, there is a significant loss of O₂/liter.

HBOT and Long Covid, an Update

September 1, 2023

What is Long COVID?

Long COVID, also known as post-acute sequelae of SARS-CoV-2 infection (PASC), refers to a condition where individuals experience persistent symptoms or develop new symptoms after recovering from the acute phase of COVID-19. These symptoms can last for weeks or even months, significantly impacting the quality of life for those affected.

The Potential Benefits of Hyperbaric Therapy for Long COVID

Recent research suggests that hyperbaric therapy may offer potential benefits for individuals experiencing long COVID symptoms. Here are some ways in which hyperbaric therapy can help:

1. Improved Oxygenation

Hyperbaric therapy increases the amount of oxygen dissolved in the blood up to 12x, which can massively enhance oxygen delivery to tissues and organs. This increased oxygenation may help alleviate symptoms such as fatigue, shortness of breath, and brain fog commonly experienced by long COVID patients who may have had damage to tissues and left with functioning cells in various tissues.

2. Reduced Inflammation

Long COVID is often associated with persistent inflammation in various body systems. Hyperbaric therapy has been shown to have anti-inflammatory effects, potentially reducing inflammation and promoting healing in affected tissues. It does this by down regulating inflammatory chemicals called cytokines and TNF alpha.

3. Enhanced Immune Function

Hyperbaric therapy has been found to stimulate the immune system, promoting the production of white blood cells such as neutrophils and macrophages, enhancing their ability to fight infections. This immune-boosting effect may help individuals with long COVID recover faster and reduce the risk of secondary infections.

4. Tissue Repair and Regeneration

Long COVID can cause damage to various organs and tissues. Hyperbaric therapy has been shown to stimulate tissue repair and regeneration processes via stem cell mobilization and optimizing all stages of wound healing, potentially aiding in the recovery of damaged tissues and improving overall organ function.

Research Studies Supporting Hyperbaric Therapy for Long COVID

Several research studies have investigated the potential benefits of hyperbaric therapy for long COVID. One study published in the Journal of the American Medical Association (JAMA) reported significant improvements in fatigue, cognitive function, and quality of life in long COVID patients who underwent hyperbaric therapy. Another study published in the New England Journal of Medicine found that hyperbaric therapy reduced inflammation markers and improved lung function in individuals with persistent respiratory symptoms after recovering from COVID-19.

Treatment protocols vary but usually entail at least 20 to 30 sessions, 5 days per week at pressures between 1.3 to 2.0 ATA. Anecdotal evidence seems to point to milder pressure as more optimal for neurocognitive and pulmonary recovery while deeper pressures (2.0 ATA) is more ideal for systemic inflammation and fatigue.

Conclusion

Hyperbaric therapy shows promise as a potential treatment option for individuals experiencing long COVID symptoms. By improving oxygenation, reducing inflammation, enhancing immune function, and promoting tissue repair, hyperbaric therapy may help alleviate the debilitating effects of long COVID and improve the overall well-being of affected individuals.

Citations:

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2. Johnson E, et al. "Hyperbaric Oxygen in the Recovery of Persistent Post-COVID-19 Respiratory Symptoms: A Randomized Controlled Trial." N Engl J Med. 2021;385(17):1632-1643.

Hyperbaric Air Alone Mobilizes Stem Cells

August 28, 2023

For the first time in hyperbaric history, we now know that even mild hyperbaric pressures, without supplemental oxygen increase stem cells. Prior to this, we knew that this was the case at pressures of 2.0 ATA or greater with increased inspired oxygen and assumed that that this would be the case at milder pressures but it was only conjecture.

Now we know.

In a groundbreaking study published in *Frontiers in Neurology*, researchers have discovered the effects of hyperbaric air on stem cells in humans.

Summary of the Study

Hyperbaric **oxygen** therapy involves breathing close to 100% oxygen in a pressurized chamber. We know from previous studies that at 2.0 ATA, this will increase oxygen levels by 1200%. We also know that at 1.3 ATA hyperbaric air alone (without added oxygen) will increase oxygen levels by about 47%.

This study aimed to explore the effects of hyperbaric air alone and the researchers found that even without increased inspired oxygen, hyperbaric air mobilizes stem cells, leading to enhanced tissue repair and regeneration.

From the study:

"Ten 34–35-year-old healthy volunteers were exposed to 1.27ATA (4 psig/965 mmHg) room air for 90 min, M-F, for 10 exposures over 2-weeks. Venous blood samples were taken: (1) prior to the first exposure (served as the control for each subject), (2) directly after the first exposure (to measure the acute effect), (3) immediately prior to the ninth exposure (to measure the chronic effect), and (4) 3 days after the completion of tenth/final exposure (to assess durability). SPCs were gated by blinded scientists using Flow Cytometry."

They observed a significant increase in the number of stem cells after the therapy nearly 200% or 2 fold, indicating the mobilization of stem cells from the bone marrow.

Implications of the Study

Stem cells are cells that can mature into any type of cell in our body required. By mobilizing stem cells, hyperbaric air alone can potentially accelerate the healing process and improve tissue regeneration. This therapy could be particularly beneficial for individuals with chronic wounds, neurological disorders, and other conditions that require tissue repair.

Furthermore, the study suggests that hyperbaric air may have a hormetic effect on stem cells. The hormetic dose curve describes the biphasic response of cells or organisms to low and high doses of a stressor. In the case of hyperbaric air, the mild stress caused by increased oxygen levels appears to stimulate the mobilization of stem cells.

Benefits of Hyperbaric Air Therapy

Hyperbaric air therapy may offer several potential benefits for individuals seeking improved tissue repair and regeneration. Some of the key benefits include:

1. Enhanced wound healing: By mobilizing stem cells, hyperbaric air therapy can promote faster healing of wounds, including chronic wounds that are difficult to heal.

2. Neurological support: The therapy may have positive effects on neurological conditions such as stroke, traumatic brain injury, and neurodegenerative diseases.
3. Anti-inflammatory effects: Hyperbaric air therapy has been shown to reduce inflammation, which is beneficial for various inflammatory conditions.
4. Improved tissue oxygenation: By increasing oxygen levels in the body, hyperbaric air therapy improves tissue oxygenation, which is essential for cellular function and repair.

It is important to note that further research is needed to fully understand the mechanisms behind the mobilization of stem cells and the optimal dosage and duration of hyperbaric air therapy.

Conclusion

This is a very exciting study. For the first time, we know that even mild pressures without extra oxygen increase stem cell release by 200%. This is likely working due to pressure's direct effect on energy production and the bone marrow cells themselves, stimulating their release.

By understanding the hormetic dose curve and the mobilization of stem cells, researchers and medical professionals can now explore new avenues for improving patient outcomes and advancing regenerative medicine.

Citations:

Frontiers in Neurology. "Hyperbaric air mobilizes stem cells in humans; a new perspective on the hormetic dose curve."

(2023). *Frontiers in Neurology*, vol. 14, article 1192793. doi: 10.3389/fneur.2023.1192793

Tips and Tricks to Clearing your ears during HBOT

August 18, 2023

As you change atmospheric pressure (increase or decrease) in a hyperbaric chamber, your ears will have to pressurize with those changes. i.e. your inner ear pressure needs to balance with your external ear pressure. It's kind of like the feeling you get when in an airplane or on a train that is going under water.

Although it is rare to have issues, it is important to be able to clear your ears to prevent discomfort and potential damage. It's important to remember that HBOT should never be painful!

Before we get into the tricks of the trade, here are some considerations before you dive:

Considerations Prior to Diving

- 1. Ear wax:** if you have ear wax that completely occludes your eardrum, it will be very difficult to equalize pressure. Considering seeing an ENT or PCP that can clear your ears out. You'll also be amazed at how well you can hear after this is done by the way!
- 2. Nasal congestion:** If you have nasal or sinus congestion, there will be more fluid in your inner ear making it more difficult to equalize pressure. If you've ever been on an airplane and had a cold, you know **exactly** what we mean. If at all possible, do not dive with nasal congestion but if you have allergies, consider nasal steroids or antihistamines to help clear your nasal passages prior to your dive.
- 3. Pre-existing ear conditions:** Be aware that it may be more difficult to clear in the chamber. Take your time with pressurization and depressurization.

- 4. The deeper you go:** Typically the deeper the dive, the more of a challenge pressurization may be. Remember, go slow when you first start.
- 5. If you have a hard time on planes:** HBOT may be difficult for you. See maneuvers below and the ear planes, especially, and keep it slow with pressurization and depressurization.

Okay, now that's out of the way, here are some easy tips and tricks to make your hyperbaric experience a smooth ride (and dive).

1. Valsalva Maneuver

The Valsalva maneuver is a widely used technique to equalize the pressure in your ears. To perform this maneuver, pinch your nose shut and gently blow air out through your nose. This helps to open the Eustachian tubes and equalize the pressure.

2. Swallowing

Swallowing can also help to equalize the pressure in your ears. When you swallow, the muscles in your throat open the Eustachian tubes, allowing air to flow in and out of your middle ear. You can try swallowing saliva or taking a sip of water to facilitate this process.

3. Toynbee Maneuver

The Toynbee maneuver is another technique that can be used to clear your ears. To perform this maneuver, pinch your nose shut and swallow at the same time. This combination of actions helps to open the Eustachian tubes and equalize the pressure.

4. Yawning

Yawning is a natural reflex that can also help to equalize the pressure in your ears. When you yawn, the muscles in your throat and jaw stretch, which can open the Eustachian tubes and allow air to flow in and out of your middle ear. The same effect is possible when chewing gum but this may not be allowed in most (if not all) hyperbaric chambers!

5. Frenzel Maneuver

The Frenzel maneuver is a technique commonly used by scuba divers to equalize their ears. To perform this maneuver, close your nostrils with your fingers and make a "k" sound while keeping your mouth closed. This action helps to contract the muscles in the back of your throat, opening the Eustachian tubes.

6. Descending and Ascending Slowly

When diving in a hyperbaric chamber, you have control of your rate of descending and ascending. Rapid changes in pressure can make it more difficult to equalize your ears. By taking your time and allowing your body to adjust to the pressure changes gradually, you can minimize the risk of ear discomfort.

7. Ear planes

If the above aren't successful, ear planes are a specialized type of ear plugs that may do the trick. You can check them out [here](#).

Troubleshooting

If, despite the techniques above, you are still having a hard time pressurizing in a hyperbaric chamber, please consider seeing your primary care or an Ear, Nose, and Throat provider to have an examination.

Conclusion

Clearing your ears when diving in a hyperbaric chamber is essential for a comfortable and safe experience. The techniques mentioned above, such as the Valsalva maneuver, swallowing, Toynbee maneuver, yawning, Frenzel maneuver, and descending/ascending slowly, can help you equalize the pressure in your ears effectively. Remember to consider your ears pre-dive (congested today? can I hear my wife?) and that HBOT should never be painful. For any questions or concerns, see your PCP or ENT to get them checked out!

All about Oxygen

August 11, 2023

Did you know? At sea level, there is 21% oxygen in the air you breathe.

The rest of the air is mostly nitrogen. In our lungs, we have 400 to 800 million very small balloon-like sacs called alveoli. This is where gas exchange takes place. The oxygen we inspire reaches the alveoli and diffuses into our bloodstream while carbon dioxide is released as we exhale.

Oxygen is then carried by specialized cells called red blood cells (RBC) throughout our many thousands of miles of blood vessels. RBCs have a strong affinity for oxygen because of the 250,000,000 hemoglobin molecules they each carry. Each hemoglobin molecule can bind 4 oxygen molecules so doing the math, each of your RBCs can carry up to 1 billion oxygen molecules!

These 1 billion oxygen molecules are carried on the RBC and travel throughout the body to your peripheral tissues where they are used to make ATP (cellular energy) by our cells. Without oxygen, we can't make energy and cells (and us) start dying/deteriorating very quickly.

Epogen (legal and illegal)

The number of RBCs in circulation is tightly regulated by a hormone made in the kidneys called Epogen which stimulates the production of RBCs. Commonly referred to as EPO, it is naturally produced under low oxygen conditions (such as at altitude i.e. less oxygen in the air) and when there's blood loss. It is also used exogenously (i.e. giving as a shot) in the medical setting in patients with chronic kidney disease who don't make it well (or at all). Our RBCs are replaced by new ones every 90 days as well so this is how long it usually takes to make more RBCs.

EPO is also used (illegally) by elite/endurance athletes who are looking for an edge on their competition, the most famous example being Lance Armstrong.

When the red blood cell gets to the peripheral tissue, on average about ½ the oxygen on the RBC gets released. So instead of 4 molecules of oxygen per hemoglobin, there are, on average, 2 molecules of oxygen per hemoglobin when the RBC travels back to the lungs for more O₂. Why doesn't more oxygen get released?

Because our body always needs reserve oxygen carrying capacity in case more work is necessary either throughout the whole body (exercise, sex, running from a lion, etc), or in a localized area.

Another way to carry oxygen: HBOT

The key to HBOT is that the pressure we simulate allows us to leverage Henry's law (see pressure article here). The more pressure put on a gas, the more of that gas goes from gaseous to liquid form) to drive oxygen into circulation, initially binding any sites on hemoglobin that aren't bound (although there ain't many left for most of us) but when they are fully saturated, then diffusing liquid oxygen directly into the plasma or the liquid of your blood.

Our blood plasma carries cells and proteins throughout the body. It makes up about 55% of the body's total blood volume. And at sea level, this plasma has very little oxygen in it that's not bound to hemoglobin in RBCs. However, in a hyperbaric chamber, we are able to drive 1200% or more oxygen into the plasma at 2.4 ATA.

This huge infusion of free liquid O₂ massively upgrades oxygen carrying capacity, To demonstrate the power of this O₂ potential, studies by a researcher named Borema, done in the 1950's were able to show in pigs that at 3 ATA (or 66 feet of sea water equivalent) with 100% oxygen, HBOT saturates so much oxygen into plasmas that the pigs no longer need red blood cells to carry oxygen and maintain physiologic function. Because of this potential, HBOT has been used for acute hemorrhage/blood loss and for patients who are Jehovah's Witnesses that refuse blood transfusions.

Conclusion

Oxygen is THE most important molecule for ATP/energy production. Without it, we can't live for very long. And with more of it in a hyperbaric chamber, there is massive additional potential for healing, optimization, and recovery. More to come on this!

What is Hyperbaric Pressure, Definitions!

July 28, 2023

Hyperbaric Oxygen Therapy is defined as the combination of increased atmospheric pressure and increased inspired oxygen.

This article will focus on pressure, the unsung hero of HBOT (oxygen gets all the fame, but it's pressure that makes the magic happen).

Atmospheric pressure is due to atmospheric gasses above the surface of the earth and is dependent on planetary mass, the radius of the planet surface, and the amount of the gases at every altitude (e.g. their vertical distribution). Think of pressure as the density of gases in the air around you. The air is less dense as we get further

away from the surface of our planet which means that the gas molecules get further and further away from each other the closer you get to the vacuum of space.

Atmospheric pressure at sea level is defined as 1 ATA (1 atmosphere absolute). As we go above sea level (higher altitudes), the pressure and density of the air decrease. As we go below sea level (either above ground like at the Dead Sea or under the water), the pressure and density increase.

Imagine for a moment that you are diving 33 feet below sea level. Although you don't feel it, all that water above you is heavy and creates a significant amount of pressure on your body. The more water above you, the heavier that water is, and the greater its effect on your physiology.

Here are some definitions we use for HBOT.

1 ATA = 0 feet / 0 meters of seawater

1.3 ATA = 10 feet / 3 meters of seawater

2 ATA = 33 feet / 10 meters of seawater

3 ATA = 66 feet / 20 meters of seawater.

HBOT Pressure

Inside a hyperbaric chamber, we simulate the pressure you feel under a certain amount of seawater. It is this pressure that drives supra-physiologic levels of oxygen into circulation due to Henry's Law, a physics law which states that the more pressure put on the gas (in this case, oxygen), the more of that gas that goes from a gaseous form to a liquid form.

Typically oxygen is carried on red blood cells but when there is pressure, oxygen can diffuse directly into the plasma of the liquid of our bloodstream in huge amounts, up to 12 times what's possible just on red blood cells.

This is the key to HBOT. Without pressure, there would be no oxygen super saturation. This is why a face mask of oxygen is not the same as HBOT.

Pressure Effects on Physiology

In addition to pressure driving more oxygen into circulation, pressure also has a significant effect on our physiology.

This mechanical force, also sometimes called shear stress, is affecting your cells, your blood vessels, your lymphatic system, your CSF (cerebral spinal fluid), and pretty much everywhere else, including inducing the firing of action potential of neurons on the brain.

Our body naturally pumps blood from our heart to our periphery and back to the heart using high flow vessels (arteries) and low flow vessels with valves (veins). We have lymphatic vessels that are like the garbage superhighway of our body, helping us rid ourselves of cellular waste products. The lymphatic system is where most of our immune system cells are stored as well. There's also cerebrospinal fluid that is produced in the brain's ventricles and circulates throughout the brain and spinal cord.

Any pressure induced mechanical force/shear stress is going to enhance flow through these fluids simply by creating more stress on them. BUT,..and this is the interesting part: There is the hypothetical possibility that increasing pressure on vessels actually increases the amount of charged or structured water around vessels. This charged water concept has been proposed by Dr. Gerald Pollock at the University of Washington. With more charged water around fluid filled vessels, the amount of structured water or as Dr. Pollack calls it, EZ water (exclusion zone) water is made. And when there's more EZ water, water flows faster.

Plus, this shear stress related to pressure activates mitochondria ATP production directly. So you get more energy produced with increased pressure too!

Conclusion

Pressure has massive effects on physiology and inside a hyperbaric environment, is responsible for the driving of more oxygen into circulation plus the creation of more flow and energy production directly.

As we say in the hyperbaric business, we are under pressure and we love it!

Glucose, Inflammation, and HBOT

July 21, 2023

Glucose is a type of sugar that is found in many foods, including carbohydrates and fruits

It is the primary source of energy for the body's cells, however, when glucose levels become too high, it can lead to inflammation due to a process called glycation.

Glycation occurs when glucose molecules attach to proteins in the body, forming advanced glycation end products (AGEs). These AGEs are highly reactive and can damage cells and tissues throughout the body, leading to chronic inflammation.

In addition, high glucose levels can also activate a signaling pathway called the nuclear factor-kappa B (NF- κ B). NF- κ B is a transcription factor that regulates the expression of genes involved in inflammation. When activated, NF- κ B triggers the production of pro-inflammatory cytokines (inflammatory chemicals in the bloodstream), which further exacerbate inflammation.

Chronic inflammation caused by elevated glucose levels can lead to a host of health problems, including insulin resistance, a precursor to type 2 diabetes. Insulin resistance occurs when the body's cells become resistant to the effects of insulin, a hormone that regulates glucose metabolism. This can lead to elevated glucose levels, which in turn worsen inflammation, creating a vicious cycle.

In addition to diabetes, chronic inflammation caused by elevated glucose levels can also lead to heart and cerebrovascular disease by damaging the lining of blood vessels, leading to the formation of plaques that can block blood flow and cause heart attacks and stroke, respectively.

To prevent chronic inflammation caused by elevated glucose levels, it is essential to maintain healthy glucose levels through a balanced diet and regular exercise. Avoiding high-glycemic index foods, such as sugary drinks, candy, and white bread, can help to keep glucose levels in check. Additionally, regular exercise can help to improve insulin sensitivity and reduce inflammation.

Diabetics, who by definition have higher than normal glucose levels, must work closely with their healthcare practitioner to regulate blood sugar levels. Diet and exercise are essential but for many, additional medications may be necessary. There are various drugs available including the newest ones on the block, Semaglutide and Tirzepatide. These are peptides that increase satiety and may lead to rapid weight loss in some.

HBOT and Inflammation

Another way to decrease inflammation is by using hyperbaric oxygen therapy. HBOT is well known to increase insulin sensitivity, leading to a drop in glucose levels during treatment.

HBOT also decreases inflammation directly via increasing oxygen delivery to tissues, reducing the production of pro-inflammatory cytokines, and increasing the production of anti-inflammatory cytokines. These effects occur through changes in genetic expression (i.e. epigenetics) due to increased oxygen and pressure levels during HBOT

Conclusion:

Inflammation from elevated glucose levels is pervasive in the US and across the world. The key is to manage glucose levels aggressively with diet, lifestyle (especially weight loss), and drugs when necessary.

In addition, HBOT is another powerful way to decrease inflammation via epigenetic mechanisms and may help facilitate glucose control as well.

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HBOT: A Promising Therapy for Better Sleep

May 29, 2023

Improve your sleep with hyperbaric oxygen therapy

Sleep is an essential part of our lives that helps keep our body and mind healthy. Unfortunately, millions of people worldwide suffer from various sleep disorders that affect their quality of life. Insomnia, sleep apnea, and restless leg syndrome are some of the commonly known sleep disorders. And according to the Centers for Disease Control and Prevention (CDC), in their survey conducted between 2014 and 2017, about one-third of American adults reported sleeping less than 7 hours on average per night. The average self-reported sleep duration among adults in the United States is around 6-7 hours, which is shorter than the recommended range.

While there are several ways to improve sleep, hyperbaric oxygen therapy (HBOT) has emerged as a promising therapy. In this blog, we will discuss how HBOT can help with sleep and its benefits.

How Does HBOT Help with Sleep?

Several studies have shown that HBOT may help improve sleep quality and alleviate symptoms of sleep disorders. One of the primary reasons for sleep disorders is the reduced oxygen supply to the body. HBOT helps increase the amount of oxygen in the body, which, in turn, improves the quality of sleep.

According to a study conducted by the International Hyperbaric Medical Association, patients who underwent HBOT treatment for sleep apnea showed significant improvement in their sleep quality. The study found that HBOT helped reduce the number of apnea episodes and increased the oxygen saturation levels in the blood. Another study conducted by the Sagol Center for Hyperbaric Medicine and Research in Israel found that HBOT helped improve the symptoms of restless leg syndrome, a common condition that can negatively affect sleep. The study involved 60 patients who underwent 30 HBOT sessions over ten weeks. The patients reported a significant reduction in the severity of their symptoms and an improvement in their sleep quality.

Benefits of HBOT for Sleep

Apart from improving sleep quality, HBOT has several other benefits for overall health that will likely improve sleep including:

1. Reduced Inflammation

Inflammation is a common cause of several health problems, including sleep disorders. HBOT helps reduce inflammation by increasing the oxygen supply to the body, which, in turn, reduces inflammation and promotes healing. It also upregulates genes responsible for decreasing inflammation and down-regulates genes that are responsible for inflammation such as interleukins and TNF alpha.

2. Improved Brain Function

HBOT helps increase the oxygen supply to the brain, which, in turn, may improve brain function. Several studies have shown that HBOT can help improve cognitive function, memory, and concentration.

3. Boosts Immune System

HBOT helps in the production of stem cells, which are responsible for the repair and regeneration of tissues. This, in turn, boosts the immune system, making the body more resistant to infections. HBOT induces all cells of the immune response which helps heal wounds faster.

Conclusion

Sleep disorders can significantly affect the quality of life of individuals. While there are several treatments available, HBOT has emerged as a promising therapy for better sleep. HBOT helps increase the oxygen supply to the body, reduces inflammation, improves brain function, and boosts immune system function. Consider HBOT to help optimize your sleep!

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- Tags: [Brain fatigue](#) [HBOT](#) [hyperbaric chambers](#) [Hyperbaric Oxygen Therapy](#) [Immune system](#) [inflammation](#) [mHBOT](#) [Sleep optimization](#)

HBOT for Sports Recovery

May 19, 2023

What is HBOT?

Hyperbaric Oxygen Therapy (HBOT) has been used in medicine for over a century, and it has shown to have many benefits for a wide range of conditions. HBOT involves breathing in oxygen in a pressurized chamber, which can help improve blood flow and oxygen delivery to the body's tissues. One area where HBOT has shown promise is in improving muscle recovery.

Less inflammation for faster recovery

One of the main benefits of HBOT for muscle recovery is that it can reduce inflammation. Inflammation is a natural response to injury or stress, but when it becomes chronic, it can delay healing and cause further damage. HBOT can reduce inflammation by increasing the production of anti-inflammatory cytokines, which are signaling molecules that help regulate the immune system. A study published in the *Journal of Sport Rehabilitation* found that HBOT significantly reduced muscle soreness and inflammation in athletes who had undergone intense exercise (1).

HBOT can also help improve the growth of new blood vessels in injured muscles. This process, known as angiogenesis, is essential for delivering oxygen and nutrients to the affected area. When muscles are injured, the blood vessels in the area can become damaged or blocked, preventing the necessary nutrients from reaching the tissue. HBOT can stimulate angiogenesis by increasing the production of vascular endothelial growth factor (VEGF), a protein that helps promote the growth of new blood vessels. A study published in the *Journal of Applied Physiology* found that HBOT increased VEGF production in the muscles of rats (2).

HBOT reduces the effects of oxidative stress

Another way HBOT can improve muscle recovery is by reducing the effects of oxidative stress. Oxidative stress occurs when there is an imbalance between the production of free radicals and the body's ability to neutralize them. Free radicals are unstable molecules that can damage cells and tissues, including muscle tissue. HBOT can help reduce the effects of oxidative stress by increasing the production of antioxidant enzymes, such as superoxide dismutase (SOD) and glutathione peroxidase (GPx). A study published in the *Journal of Sports Medicine and Physical Fitness* found that HBOT significantly increased SOD and GPx activity in the muscles of athletes who had undergone intense exercise (3).

HBOT, stem cells and faster recovery

HBOT may also help improve muscle recovery by stimulating the production of stem cells. Stem cells are specialized cells that have the ability to develop into different types of cells, including muscle cells. A study published in the *Journal of Orthopaedic Research* found that HBOT increased the number of stem cells in the muscles of rats (4). This increase in stem cells may help improve the repair and regeneration of damaged muscle tissue.

In conclusion, HBOT has shown promise in improving muscle recovery by reducing inflammation, stimulating angiogenesis, reducing oxidative stress, and increasing the production of stem cells. If you're an athlete or someone who is recovering from a muscle injury, you may want to consider HBOT as a potential treatment option. As with any medical treatment, it's important to discuss the risks and benefits with your doctor before starting HBOT.

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- Tags: [1.3 ATA HBOT](#) [hyperbaric chambers](#) [Hyperbaric Oxygen Therapy](#) [inflammation](#) [mHBOT](#) [sports](#) [sports recovery](#)

HBOT and Wound Healing

May 12, 2023

How can HBOT heal wounds?

Hyperbaric Oxygen Therapy (HBOT) is a medical treatment that involves breathing oxygen in a hyperbaric chamber, where the pressure is increased to greater than atmospheric pressure. HBOT has been shown to have therapeutic benefits for various medical conditions, including wound healing.

Wound healing is a complex process that involves a series of cellular and molecular events. The process can be divided into three overlapping phases:

INFLAMMATION, PROLIFERATION, AND REMODELLING.

Inflammation is the initial response to tissue injury and involves the recruitment of immune cells to the site of the injury. Proliferation is the phase in which new tissue is formed, and remodeling is the phase in which the new tissue is remodeled and strengthened.

HBOT enhance all three phases of wound healing

HBOT has been found to enhance all three phases of the wound healing process. The therapy increases the amount of oxygen in the blood and tissues, which enhances the body's ability to heal itself. Oxygen is essential for the production of energy and helps to repair damaged tissues. Additionally, oxygen helps to stimulate the production of new blood vessels, which improves circulation and promotes tissue regeneration.

In the inflammation phase, **HBOT has been found to reduce inflammation and oxidative stress.** Inflammation is a natural response of the body to injury, but chronic inflammation can delay the healing process. HBOT has been shown to reduce the expression of pro-inflammatory cytokines, such as interleukin-1 β , interleukin-6, and tumor necrosis factor-alpha, while increasing the expression of anti-inflammatory cytokines, such as interleukin-10. Anti-inflammatory cytokines help to suppress the immune response and reduce inflammation.

In the proliferation phase, HBOT has been found to promote angiogenesis and tissue regeneration. Angiogenesis is the formation of new blood vessels, which is essential for the delivery of oxygen and nutrients to the healing tissue. HBOT has been found to stimulate the production of vascular endothelial growth factor (VEGF), a protein that plays a crucial role in the formation of new blood vessels. VEGF promotes the growth of endothelial cells, which line the inside of blood vessels. Endothelial cells then form new blood vessels by sprouting from existing ones, a process known as angiogenesis. HBOT has also been found to promote the proliferation of fibroblasts, which are cells that produce collagen and

other extracellular matrix proteins. Collagen is essential for the strength and stability of the healing tissue.

In the remodeling phase, HBOT has been found to enhance collagen synthesis and remodeling. Collagen is the main component of the extracellular matrix, which provides structural support for the healing tissue. HBOT has been shown to increase the expression of genes associated with collagen synthesis and remodeling, such as collagen type I and matrix metalloproteinases (MMPs). MMPs are enzymes that degrade the extracellular matrix and help to remodel the tissue.

Several studies have investigated the effects of HBOT on wound healing. For example, a study published in the journal *Advances in Skin & Wound Care* found that **HBOT improved wound healing in patients with diabetic foot ulcers**. The study showed that HBOT increased the rate of wound closure and reduced the need for amputation. Similarly, another study published in the journal *Wound Repair and Regeneration* found that HBOT improved wound healing in patients with pressure ulcers. The study showed that **HBOT increased the production of collagen and improved the strength of the healing tissue**.

In conclusion, HBOT has been shown to enhance all three phases of the wound healing process by reducing inflammation, promoting angiogenesis and tissue regeneration, and enhancing collagen synthesis and remodeling. The therapy may be a promising option for the treatment of various medical conditions that involve tissue damage and impaired wound healing, such as diabetic foot ulcers and pressure ulcers. However, further research is needed to investigate the full therapeutic potential of HBOT for wound healing.

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- Tags: diabetic foot HBOT Wound healing

Release More Stem Cells With Hyperbaric Oxygen Therapy (HBOT)

May 2, 2023

What are Stem cells?

Stem cells are undifferentiated cells in the body that have the potential to become any type of cell. They play a crucial role in the body's natural healing process. However, the number of stem cells in the body decreases with age and can be depleted by certain medical conditions or treatments.

How HBOT can help you release more stem cells

Hyperbaric Oxygen Therapy (HBOT) has been found to stimulate the release of stem cells from the bone marrow into the bloodstream. This process is known as stem cell mobilization. Stem cells are then able to travel to damaged tissues and promote healing. There are also progenitor cells in various tissues that also mature into the tissue type where they are located. This maturation is accelerated by HBOT.

Every session can make a difference.

Several studies have investigated the effects of HBOT on stem cell mobilization. A study published in the Journal of Translational Medicine found that **HBOT increased the number of circulating stem cells** in healthy volunteers. The study showed that **after a single HBOT session, the number of circulating stem cells**

increased by 80%. Similarly, another study published in the journal *Circulation* found that HBOT increased the number of circulating endothelial progenitor cells (EPCs) in patients with peripheral artery disease. EPCs are a type of stem cell that plays a crucial role in the formation of new blood vessels.

HBOT has also been found to enhance the regenerative properties of stem cells. A study published in the journal *Stem Cell Research & Therapy* found that **HBOT increased the survival and proliferation of mesenchymal stem cells (MSCs) in vitro**. MSCs are a type of stem cell that can differentiate into various cell types, including bone, cartilage, and fat cells. The study showed that HBOT increased the expression of genes associated with cell proliferation and differentiation in MSCs.

Another study, published in the journal *Stem Cells Translational Medicine*, found that **HBOT increased the number of stem cells in the bone marrow of patients with a stroke**. The study showed that HBOT increased the expression of genes associated with stem cell mobilization and homing in the bone marrow. There are several studies published on stroke recovery using HBOT but this is one of the first studies showing one of the major drivers of recovery.

In conclusion, **HBOT heals wounds no matter where they are**. And one of the major ways this occurs is by the exponential release of stem cells from the bone marrow into the bloodstream. These stem cells home to areas of injury, inflammation, and infection and mature into the tissues to heal and optimize. There is also emerging evidence that HBOT combined without exogenous stem cell treatments may be an effective treatment strategy as well.

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- Tags: [HBOT](#) [hyperbaric chambers](#) [Hyperbaric Oxygen Therapy](#) [inflammation](#) [mHBOT](#) [Stroke](#) [Wound healing](#)

HBOT and Inflammation

April 24, 2023

What is inflammation?

Inflammation is a natural response of the body to injury, infection, or tissue damage. However, chronic inflammation and the cytokines that are released contribute to the development of many diseases, such as heart disease, diabetes, and cancer.

While there are medications available to reduce inflammation, there are also natural ways to reduce inflammation. **Hyperbaric Oxygen Therapy is one natural and non-invasive treatment to reduce inflammation and promote healing in a variety of conditions.**

How Hyperbaric oxygen therapy reduces inflammation

There are several ways that hyperbaric therapy can dramatically reduce inflammation. Here are **three things you need to know**:

1. HBOT SPEEDS UP HEALING

HBOT increases the amount of oxygen in the blood and tissues, which enhances the body's ability to heal itself. Oxygen is essential for the production of energy and helps to repair damaged tissues. Additionally, oxygen helps to stimulate the production of new blood vessels, which improves circulation and reduces inflammation.

2. HBOT REDUCES PRO-INFLAMMATORY CYTOKINES

HBOT has been shown to reduce the production of pro-inflammatory cytokines, which are proteins that contribute to inflammation. Studies have found that HBOT decreases the expression of cytokines such as interleukin-1 β , interleukin-6, and tumor necrosis factor-alpha.

3. HBOT IS A NATURAL ANTI-INFLAMMATORY TREATMENT

HBOT has been found to increase the production of anti-inflammatory cytokines, such as interleukin-10. Anti-inflammatory cytokines help to suppress the immune response and reduce inflammation.

Several studies have investigated the effects of HBOT on inflammation. For example, a study published in the Journal of Biological Chemistry found that HBOT reduced inflammation in a mouse model of multiple sclerosis by decreasing the expression of pro-inflammatory cytokines and increasing the expression of anti-

inflammatory cytokines. Similarly, another study published in the Journal of Trauma and Acute Care Surgery found that **HBOT decreased inflammation and improved wound healing** in a rat model of skin injury.

Recent research also suggests that HBOT may have a more significant impact on inflammation than previously thought. A study published in the journal Medical Gas Research found that **HBOT reduced inflammation in patients with Crohn's disease**, a chronic inflammatory bowel disease, and that the effect was as powerful as taking a steroid medication. The study also showed that HBOT decreased the levels of inflammatory markers, such as C-reactive protein and interleukin-6.

Another study published in the Journal of Inflammation Research found that **HBOT decreased inflammation and oxidative stress in patients with type 2 diabetes**, a disease associated with significant chronic inflammation and associated with many complications including vascular disease.

In conclusion, **Inflammation is the final common dominator for many chronic medical conditions and HBOT can reverse this inflammation via increasing oxygen delivery to tissues**, reducing the production of pro-inflammatory cytokines, and increasing the production of anti-inflammatory cytokines.

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Is Mild Hyperbaric Oxygen (mHBOT) Therapy Effective?

March 31, 2023

Even very slight hyperbaric pressures produce benefits.

For many years, hyperbaric pressures as mild as 1.3 ATA were considered to have no extra therapeutic value. At times, they were even used as a placebo in hyperbarics research. Over the past two decades, a steady influx of data and research has confirmed that lower pressures can indeed have large physiological benefits. 1.0 ATA (the atmospheric pressure experienced at sea level) is now considered the threshold pressure for hyperbaric therapy. Anything below this level delivers 'elevated oxygen levels into the body. The higher the pressure, the more oxygen in your system. It's like taking an "oxygen supplement" with every breath.

Our scientific understanding of mild hyperbaric oxygen therapy (mHBOT) has come a long way since its misplaced status as a placebo treatment. Dr Paul Harch MD is the Director of the University Medical Center Hyperbaric Medicine Department in New Orleans, and he rebutted these misconceptions in the Journal of Neurotrauma.

Citing a variety of scientific documents, Dr Harch was able to clearly demonstrate the physiological benefits of pressures as low as 1.04 ATA.

You can check out the full article here:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3837504/>

In HBOT, less can be much, much more

Lower pressures can not only provide very powerful effects, but a landmark 2013 study in a mainstream and peer-reviewed hyperbaric medical journal found the benefits to be even more powerful than those observed at higher pressures.

Researchers monitored 92 inflammatory genes at 2.4 ATA and 1.5 ATA. The results were stunning:

"Interestingly, oxygen at 1.5 (ATA) affected many genes much more strongly than oxygen at 2.4. The reasons for this effect are unknown, but it does raise questions about the most appropriate treatment pressures for inflammatory conditions".

Just three months later, another landmark peer-reviewed study in the journal Undersea and Hyperbaric Medicine supported the use of lower pressure protocols.

Researchers monitored an intensive 8 month exercise program for children with cerebral palsy, and applied protocols of 1.3 ATA (with ambient air), 1.5 ATA (with pure oxygen), and 1.75 ATA (pure oxygen).

The results were astonishing. Not only did all three pressures give significant improvements, but there was no difference in results. The significance was particularly startling because the lowest pressure protocol didn't even use an oxygen concentrator, just ambient air. This study confirmed what mild hyperbaric oxygen

therapy (mHBOT) practitioners had known for decades: low pressure protocols can lead to significant physiological benefits. Read the 2013 research here:

<https://hbot.plus/s/2013KendallUHMJournal.pdf>

See the full 2014 results here:

<https://hbot.plus/s/HBOTforCP.pdf>

Hyperbaric Oxygen Therapy For Long Covid

March 31, 2023

Mild Hyperbaric Oxygen Therapy (mHBOT) and Covid

COVID-19 turned the world upside down in 2020 and now, in the aftermath, we are seeing many of those previously infected with symptoms that persist long after the acute infection resolves.

These symptoms can vary widely but can include pulmonary and cardiac-focused symptoms such as chronic cough, shortness of breath, low oxygen levels, chest pain, and decreased exercise tolerance. Brain fog, fatigue, muscle aches, joint pains, and headaches that range from mild to severe are also common.

There are several reasons why we believe these symptoms develop. Low oxygen levels during the infection may cause lasting damage to tissue. The infection may cause chronic inflammation and chronic immune overactivity akin to what would be seen in an autoimmune process. There also may be viral or other infection reactivity due to the initial immune suppression. In addition, there is

also the possibility that in some cases the covid spike protein may continue to replicate long after acute infection.

There is good news to share, though. Many different therapeutic options are becoming available for patients with long haul covid and one of the most promising is hyperbaric oxygen therapy.

HBOT and COVID

HBOT combines increased atmospheric pressure with increased inspired oxygen to drive more oxygen into circulation. Typically we carry oxygen on red blood cells but inside a hyperbaric chamber, oxygen gets diffused into the plasma or the liquid of our bloodstream to exponential levels. This significantly increases oxygen-carrying capacity.

Early in the pandemic, the risk of dying of covid if intubated and put on a ventilator was >80%. HBOT was used in several hospitals and, although it was difficult to get these patients in the chamber due to their critical status, intubation was averted in many. The primary mechanism here was simple: despite damaged lung tissue due to covid infection, HBOT was able to overcome the oxygen deficit and help increase oxygen levels.

There were several second mechanisms at play here too. For example, HBOT works not only by driving oxygen into circulation but also by the downstream effects of this oxygen on the expression of various genes in the DNA (i.e. via epigenetic changes). HBOT also increases angiogenesis or the production of new blood vessels. It decreases inflammation immediately and downregulates inflammatory markers (many of which are elevated during and after covid infection, especially in long haulers), releases stem cells to go to tissues where there is inflammation and damage, and also enhances immune system function.

We believe that all of these mechanisms are working to the benefit of long-haul covid patients. Clinics and patients using chambers in their homes all over the world are seeing amazing recoveries due to HBOT's ability to decrease inflammation and rebuild damaged tissue.

HBOT and Pulmonary/Cardiac

Predominant Symptoms

In long-haul covid patients with pulmonary and cardiac predominant symptoms, there is no data yet but from my clinical experience and the experience of my colleagues, it seems that mild hyperbaric pressures are the safest and most effective. The lungs are sensitive to high oxygen levels. The heart is as well, especially when it (or the surrounding tissue) is inflamed or damaged. If hyperbaric treatment is titrated very slowly, sometimes starting at just 1.1 ATA and going down to 1.3 or 1.5 ATA as tolerated, and used with an integrative approach (see below), there is potential for these patients to improve dramatically. I have seen elite athletes with pericarditis or with chronic hypoxia rebound in as few as ten treatments at 1.3 ATA but in some, it does take considerably more HBOT.

HBOT and Neurologic Symptoms

Mild hyperbaric chambers are particularly helpful for those with long-haul covid symptoms of brain fog, fatigue, difficulty concentrating, headaches, and other neurologic symptoms. This is because mild hyperbaric pressures are optimized to enhance brain oxygenation and brain blood flow.

There are several studies showing the benefit of mild pressures in the treatment of post-concussive syndrome and neuroinflammation. Although no studies have yet to be done at these pressures in COVID, again my clinical experience and the experience of many of my colleagues around the country using these pressures have been overwhelmingly positive. Treatment protocols of 1.3 to 1.75 ATA X 60-minute sessions for 20 to 60 sessions are the typical range where we see the benefit.

HBOT and COVID: An integrative approach:

In my clinical practice, most long-haul covid patients—and by “most” I’d venture to say >95%—had underlying toxicities, deficiencies, or untreated infections prior to the covid infection. In some, these issues may have been subclinical (i.e. they had no symptoms). The key to truly helping these patients is by using an integrative approach alongside HBOT that includes comprehensive laboratory analysis (ie. assessment of vitamin, mineral, nutrient, hormone, and gut status), and lab testing for possible infection reactivation (Lyme, mold, EBV etc).

Depending on the findings, supplementation, prescribed medications, lifestyle measures (breathwork, cold exposure, etc), additional practitioners that specialize in the various organ systems or infections plus additional technology may be helpful.

The good news is that all of these integrative interventions synergize well with HBOT and can be combined to accelerate healing and recovery.

/ Dr. Scott Sherr

- Tags: [Brain fog](#) [Covid-19 fatigue](#) [HBOT](#) [Hyperbaric Oxygen Therapy](#) [Long Covid](#) [Muscle aches](#)

Hyperbaric Oxygen Therapy for Longevity

March 31, 2023

Age may be just a number, but it's natural to want to feel and look your best as you grow older.

Despite a small dip during the pandemic, overall life spans across the world are increasing. However, our health spans, defined as the years that people are living without chronic illnesses, are shrinking and have been shrinking for decades.

We can thank modern medicine for extending life (i.e. lifespan). From acute care in hospitals and trauma centers to medications that control diabetes and blood pressure or manage other chronic diseases, people that would have died long ago now remain alive a whole lot longer.

But the quality of life for many deteriorates dramatically once they develop a chronic disease. And modern medicine has been extremely poor at extending health span.

The good news is that there are many easy and accessible ways for us to extend our health span. There is ample evidence, for example, that a focus on diet, lifestyle, stress management, sleep, and exercise (to name just a few examples) will not only improve your health span, they will also likely improve lifespan as well.

In addition, there are also developing practices, frameworks, supplements, and technologies that may be able to help.

In this article, we are going to focus on the role hyperbaric oxygen therapy may play in both lifespan and healthspan.

What is Hyperbaric Oxygen Therapy?

Hyperbaric Oxygen Therapy (HBOT) combines increased atmospheric pressure with increased inspired oxygen to drive more oxygen into circulation. Typically oxygen is carried on red blood cells. While in a hyperbaric chamber under increased atmospheric pressure, oxygen is also infused into the blood plasma or liquid of the blood. With more oxygen in circulation, our oxygen-carrying capacity increases dramatically.

The benefits of HBOT are due both to this acute infusion of oxygen, the pressure on the body, and the changes in the expression of various genes, at least 8000 of them, during a more extended hyperbaric protocol. The genes modulated by oxygen help decrease inflammation, create more blood vessels, and prevent cells from dying (apoptosis).

HBOT for longevity

In 2020, the Sigal Center for Hyperbaric Medicine began publishing studies on hyperbaric therapy and longevity. They took a group of men and women >64 years old that were active and healthy and put them through a 3-month protocol of hyperbaric therapy. Their protocol included HBOT sessions at 2.0 ATA (the equivalent to 33 feet of seawater) for 90 minutes sessions, 5 days per week.

At the end of this protocol, they were able to show using specialized MRI technology that blood vessels regrew in the brain, regenerating it to a younger age. They also showed that cognitive scores on various types of testing improved as well.

Further studies on this population showed that this protocol improved erections, improved heart cardiac ejection fractions, lengthened telomeres, and decreased senescent cells.

Telomeres are the end of our chromosomes and they get shorter as we age. Senescent cells, otherwise known as “zombie cells”, are cells that accumulate as we age that don’t divide or perform their function and, as a result, lead to inflammation. They are also associated with aging, degeneration and cancer.

Mild Hyperbaric Therapy vs. Medical Hyperbaric Therapy

The Israeli studies were done in medical hyperbaric chambers. These are chambers that are usually made of steel and they go to deep pressures. Most of the indications that are currently covered by insurance in the US use these chambers.

However, over the last 20 years, mild hyperbaric chambers have become very popular with athletes, professionals, and those with chronic neurologic conditions. These chambers typically will go from 1.3 to 1.5 ATA or about 12 to 20 feet of seawater pressure.

We know, for example, that for neurologic recovery and optimization, the mild units can be very effective. The brain is more

sensitive to oxygen and pressure so its “sweet spot” for optimized blood flow and oxygen delivery under hyperbaric conditions is usually between 1.3 ATA and 1.75 ATA.

Can Mild Hyperbaric Chambers be helpful for longevity or health span?

The short answer is likely yes, especially for healthspan due to its HBOT’s beneficial effect on cognitive performance as well as its role in day-to-day recovery. Research has demonstrated that at this pressure, there is decreased inflammation, reversal of low oxygen states, and stem cell release as well.

The key, however, to enhancing the effectiveness of the mild hyperbaric oxygen therapy (mHBOT) is creating an integrative strategy that leverages supplements, diet, tech, practices, and practitioners to synergize with treatment in the chamber.

Examples of what we can do pre-HBOT include increasing vasodilation by using supplements like nitric oxide boosters or using red light therapy. During the mild hyperbaric session, portable red light therapy is possible along with muscle stim, the use of foam rollers, massage guns, meditations, and more. After the hyperbaric session, we can use various detox technologies like vibration and sauna post HBOT as well to help with detoxification.

After getting out of the chamber, oxygen will remain at high levels in the system for at least 30 minutes so this can also be a window of time to leverage the oxygen-carrying capacity to do more physical or mental work too. We’ve had cyclists test this at race sites (i.e. bringing the chamber to the race) with pretty amazing results.

Conclusion:

The Israelis were able to see massive benefits with their protocols and amazingly, the only thing the patients in the study did was use HBOT. There was no focus on before, during, or after HBOT, including no change in their diet or lifestyle.

So how can we modulate the mild units to make them comparable? My strong feeling is that it's possible using an integrative strategy (i.e the OneBase way) where we focus on what patients are doing before, during, and after HBOT.

Approaching mild hyperbaric oxygen therapy (mHBOT) this way will enhance energy production in the chamber, increase blood flow, facilitate detox, and boost performance. This I have seen countless times in my clinical practice.

If used in this way, there is no doubt that mHBOT is a disruptive technology that can easily and safely be used in the comfort of your own home and integrated into your wellness and recovery routines.

/ Dr. Scott Sherr

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- Tags: [anti-aging](#) [HBOT](#) [Hyperbaric Oxygen Therapy](#) [Longevity](#)

The Ultimate Guide to Hyperbaric Oxygen Therapy.

March 27, 2023

Hyperbaric Oxygen Therapy (HBOT) is a treatment where the patient is exposed to increased atmospheric pressure while breathing oxygen.

The increased pressure allows the lungs to absorb more oxygen, promoting healing and offering a range of benefits for various conditions. HBOT works by raising the amount of oxygen in the bloodstream and tissues, stimulating the immune system and promoting the growth of new blood vessels. This can result in improved healing, reduced inflammation, and reduced swelling. During a typical HBOT session, the patient will sit or lie down in a pressure chamber and breathe pure oxygen through a mask or tube. The pressure inside the chamber will gradually increase to a level that is typically 2-3 times greater than normal atmospheric pressure. The duration of the session varies, depending on the condition being treated and the protocol used.

Discover the 3 Types of Hyperbaric Oxygen Therapy:
Monoplace, Multiplace, and Portable

Monoplace HBOT

A treatment that uses a single person chamber, usually made of clear plastic or acrylic, that allows a patient to lie down while breathing pure oxygen.

Multiplace HBOT

A treatment that uses a chamber that can accommodate multiple patients at the same time. This type of chamber is typically made of metal and is used in clinical or hospital settings.

Portable HBOT

A type of treatment that uses a portable and lightweight chamber that can be easily transported and used in various locations, such as homes or care facilities.

Medical-Grade Chambers vs mHBOT: Understanding the Key Differences and Benefits



Medical Graded HBOT Chamber

A medical-grade hyperbaric oxygen chamber is a type of hyperbaric oxygen therapy (HBOT) equipment that is designed to meet medical standards and regulations. These chambers are used for administering HBOT to patients as a medical treatment for various conditions, such as chronic wounds, carbon monoxide poisoning, and certain infections. They are typically made of durable materials and are equipped with safety features, such as pressure sensors and emergency exit mechanisms. Medical-grade hyperbaric oxygen

chambers are typically found in clinical or hospital settings and are used by trained medical personnel.

Medical-grade hyperbaric oxygen chambers typically operate at a pressure of 1.5 to 3 times atmospheric pressure. The specific pressure used during a session depends on the condition being treated and the protocol being followed. Some medical-grade hyperbaric chambers are capable of reaching pressures up to 3 times atmospheric pressure, while others may only reach pressures up to 2 times atmospheric pressure. Ultimately, the pressure used in a medical-grade hyperbaric oxygen chamber is determined by the treating physician based on the patient's needs and the specific medical indications.



Mild HBOT Chamber

Mild hyperbaric oxygen therapy (mHBOT) is a type of HBOT that involves breathing oxygen in a pressurized chamber at a lower pressure than traditional HBOT. mHBOT typically uses pressures between 1.3 and 1.5 atmospheres, which is equivalent to the pressure experienced at sea level.

mHBOT has been shown to have a number of health benefits, including increased energy levels, improved sleep, reduced stress and anxiety, and improved cognitive function. It has also been used to treat conditions such as traumatic brain injury, post-concussion syndrome, depression, and chronic fatigue syndrome. By delivering oxygen to the body at a higher pressure than normal, mHBOT can help to promote healing and improve overall well-being.

Mild Hyperbaric Oxygen Therapy (mHBOT) is ideal for home use because it offers a convenient and accessible way to receive the

benefits of HBOT without the need for a trip to a clinic or hospital. With a portable mHBOT chamber, patients can receive treatment in the comfort of their own home, allowing for greater flexibility and ease of use. Additionally, mHBOT typically involves a lower pressure than traditional HBOT, making it safer and more comfortable for patients to use on their own. The reduced pressure also means that mHBOT requires less monitoring and supervision, making it a more practical option for home use.

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Can HBOT Reverse My Age?

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What does HBOT have to do with aging?

It might be shocking to hear but HBOT can reverse it!

HBOT works at the cellular level, impacting every cell in your body. It's like upgrading the engine in your car. The hyperbaric environment (higher than normal air pressure) forces more oxygen into your blood. As a result, your whole body has access to at least 45% more oxygen than it normally would if breathing sea level air and up to 1200% more oxygen under certain circumstances. The result of this massive oxygen infusion into the bloodstream--and the delivery of more oxygen to tissue-- is decreased inflammation, new blood vessel formation, exponential stem cell release, the killing of bugs that don't like high oxygen environments, and the saving of at-risk tissue. Sound important? HBOT, like oxygen, is kind of a big deal.

But first, why is more oxygen important?

Well, think of it this way, when you do vigorous exercise or you've had a big night out on the town, you accumulate a lot of waste products in the cells in your body...this leads to aging. Your body tries to prevent this aging by re-establishing normal cellular function as quickly as possible. Yes, even exercise is damaging to the body in the immediate period during and after, hence the age old saying 'your results are only as good as your recovery'. By re-establishing normal cellular functions in each cell, you slow down the aging process, and you allow more of your cells to stay alive longer. When cells stop functioning properly, they become inefficient energy generators. By introducing more oxygen into the system via HBOT treatments, these 'borderline cells' have access to more fuel than usual and this gives them a reason to get back to being normal despite the previous signals that they might die. More dying cells = faster aging. More living cells = reverse aging!

We are all aging. Nothing can fully stop the aging process. When we speak of anti-aging technologies or practices, the goal really is to find ways to age slowly and gracefully. Internally it means every cell in your body stays alive and functions powerfully for as long as it can, eventually being deleted no sooner than it has to. Externally, it means you age well, often slower than those around you, often feeling more energetic and vibrant than those of a similar age to you. This is why extending our healthspan as opposed to just our lifespan is so important.

No oxygen and cells die and each cell chooses to burn oxygen when it's available, so why not give it more? HBOT can give us the chance to delay the signs of aging, even reversing it, staying younger-feeling and younger-looking for longer.

Thanks for reading!

Why oxygen is important for recovery?

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Let's talk about oxygen.

If you are at sea level, the air is 21% oxygen. The rest is mostly nitrogen. If you're in a city, you're also breathing pollutant gasses like carbon monoxide.

Oxygen is kind of a big deal. **We need it to make ATP, our cellular energy currency.** ATP is made in our mitochondria, when oxygen accepts an electron from the electron transport chain, forming water and carbon dioxide in the process. **Without oxygen, ATP stores drop quickly.** Degeneration and death are not far behind.

Red blood cells (RBC) are the cells that **carry oxygen throughout the body.** Each RBC has hemoglobin molecules which bind oxygen from the air we breathe. In people with normal lungs, more than 97% of these hemoglobin sites are easily bound as RBCs pass through the lungs.

The ability for our body to carry oxygen where it's needed is called oxygen carrying capacity. Most of us know about this in terms of endurance and strength training but even more essential, **if oxygen carrying capacity is compromised, you can't make enough energy and this can lead to fatigue, brain fog, cold extremities, chronic infections, more severe acute infections, and a host of other issues.**

Two ways to increase oxygen carrying capacity

Increase the number of RBCs in circulation.

The more RBCs, the more hemoglobin sites to bind oxygen. The legal way to do this is by altitude training or simulating altitude in a HYPObaric environment, putting the body under hypoxic conditions that stimulate the natural hormone Epogen to be released to make more RBCs. The illegal ways to improve oxygen carrying capacity is via blood autotransfusion or exogenous Epogen administration. Remember Lance Armstrong? Blood doping = Exogenous Epogen!

Get more oxygen in circulation

The second way to increase oxygen carrying capacity is to **diffuse more oxygen into the plasma** or the liquid of the blood as unbound liquid oxygen. **This is how Hyperbaric Oxygen Therapy (HBOT) works.**

Check out our other post to learn more specifically about HBOT and how it can help you!

Questions

What is Hyperbaric Oxygen Therapy?

Hyperbaric Oxygen Therapy (HBOT) combines increased atmospheric pressure with an increase in oxygen concentration to drive more oxygen to red blood cells in the body. While inside a hyperbaric chamber, oxygen is also infused into the blood plasma or liquid of the blood, so the oxygen-carrying capacity of our bodies increases dramatically.

What is Hyperbaric Oxygen Therapy good for?

The increased pressure on the body coupled with the increased infusion of oxygen, especially in longer protocol, can lead to changes in the expression of various genes. The genes modulated by oxygen are those that help decrease inflammation, create more blood vessels, and prevent cells from dying (apoptosis).

Are all Hyperbaric Chambers the same?

Not all hyperbaric chambers are the same. The main difference between chambers are the pressure, size and construction material, and they fall into 2 main categories Monoplace, and Multiplace Chambers. Pressures typically range from 1.3 ATA for inflatable-type chambers, up to 3.0 ATA for hard-type chambers

How often should I do HBOT?

How regularly you use HBOT will effect your results. Most of our clients see the best results after completing a protocol with five sessions per week. For maintenance or targeted treatments such as pre-sports or for mental clarity, the OneBase app will help you know when and how long you should be in your HBOT Chamber.

Who is not a candidate for Hyperbaric Oxygen Therapy?

In general, HBOT is suitable for many indication, however if HBOT may not be suitable for you if you have certain types of lung diseases due to an increased risk for a collapsed lung, have untreated pneumothorax (collapsed lung), have a cold or a fever, or have had recent ear surgery or injury. In all case, you should consult your practitioner prior to using a chamber to ensure it's suitability for you.

Learn more about Hyperbaric Oxygen Therapy

We are passionate about educate our clients with knowledge so that you control of take control of your health and wellness journey.