

THE ULTIMATE GUIDE TO

RED LIGHT THERAPY

**Benefits Of Red
and NIR Light
Therapy**

A R I W H I T T E N

The Ultimate Guide to Red and Near-Infrared Light Therapy

**Benefits of Near-Infrared and Red Light
Therapy**

By Ari Whitten

Benefits of Near-Infrared and Red Light Therapy

Today, research into the power of red light to improve health and treat disease is really gaining momentum. We are learning that red and near-infrared light therapy can benefit virtually every system of the body and can even improve the way you look– it can help you to shed inches of fat, reduce the signs of aging, regrow hair, increase the results you get from your workouts, reduce pain, speed healing, boost hormonal health, and lower inflammation.

So now, let's talk about the specific benefits of red and near-infrared light that have been shown in studies. Here are the major benefits that have been proven by scientific research for near-infrared and red light therapy:

Reverse Skin Aging and Get Youthful Skin with Red Light Therapy and Near-Infrared Light Therapy

Red and near infrared light are working wonders in the anti-aging communities, and dermatologists and plastic surgeons, even dentists who do Botox and other treatments are capitalizing on the incredible powers of red light for anti-aging.

Because red light stimulates both collagen and elastin production, eradicates lines and wrinkles, as well as the appearance of scars, surface varicose veins, acne, and cellulite, red light therapy is fast becoming recognized as a safe and welcome alternative to injections and surgeries for anti-aging and skin rejuvenation.

Collagen is important — not just for giving us youthful skin and helping us avoid that saggy “schnauzer” look around the neck and jowls — collagen is needed to keep the *entire* body youthful, resilient, strong, and vital. In fact, collagen is the most abundant protein in the entire body. Even more important than what we can see on the surface of our body, collagen is also what gives our muscles, skin, blood vessels, bones, and digestive system the healthy tissues that they need to keep us healthy, strong, and free from disease. In some schools of medicine popular in Europe, physicians put a lot of emphasis on keeping the “extra-cellular matrix” (the fibrous skeleton that surrounds and supports our cells) healthy, and dysfunction in the extracellular matrix is seen as a major source of disease. Why is this important? Because collagen is an integral part of the extracellular matrix, and red and near-infrared light are integral in supporting the collagen networks of our body.⁷⁴ Supporting the health of your extracellular matrix may very well turn out to be far more vital for overall health than we currently understand.

Red and near-infrared light therapy has been widely researched and is a proven anti-aging, skin improvement tool that brings numerous positive effects to facial skin and skin all over the body. Repairing damage from UV rays requires that skin be able to repair cellular and DNA damage, much as it does when healing from wounds. Red light does this extremely well through stimulating collagen synthesis and fibroblast formation, anti-inflammatory action, stimulation of energy production in mitochondria, and even stimulating DNA repair.⁷⁵

A wealth of human studies is proving near-infrared and red light therapy can reverse the signs of aging, repair damage from UV rays, and reduce the appearance of lines, wrinkles, and even hard to remove scars.

A 2013 issue of *Seminars in Cutaneous Medicine and Surgery* featured a review of the research that highlighted dozens of studies proving near-infrared and red light therapy can reduce the signs of aging.⁷⁶

Another review of the research by Harvard professor Michael Hamblin, PhD has found that red and near-infrared light therapy can:

- reduce the signs of damage, DNA damage,⁷⁷ and aging from UV rays⁷⁸
- reduce wrinkles⁷⁹
- reduce color patches, hyperpigmentation, and skin discoloration⁸⁰
- enhance collagen synthesis and collagen density (research has shown it can enhance production of collagen by 31%)^{81,82}
- accelerate repair in the epithelial layer of skin⁸³
- combat other skin conditions like acne, keloids, vitiligo, burns, herpes virus sores, and psoriasis⁸⁴
- speed wound healing by enhancing skin tissue repair and growth of skin cells⁸⁵



In short, near-infrared and red light therapy is offering a new, completely safe and non-invasive alternative to various anti-aging skin surgeries, Botox injections, and more abrasive chemical peels. For combating skin aging, red and near-infrared light is an extraordinarily powerful tool.

Slow Hair Loss and Re-Grow Hair with Near-Infrared and Red Light Therapy

Red light has also been shown to help with certain types of hair loss. Red light has proven to help both women and men with various conditions to regrow hair and even thicken the diameter of individual hair strands. Near-infrared and red light therapy has proven to help women with alopecia to significantly regrow and thicken hair.⁸⁶ Near-infrared and red light therapy has also proven to regrow hair in men with hair loss in several studies.^{87,88,89,90,91}

To get a little more detailed on the mechanisms, basically hair growth takes place in several phases:

- Anagen – growth phase
- Catagen – the hair transitions upwards towards the skin pore
- Telogen – the dermal papillae (are of blood supply) fully separate from the hair follicle. (After 5-6 weeks, the dermal papillae move upward to meet the hair follicles again and the hair matrix starts forming more hair – i.e. to go back to the anagen phase.)

Red and near-infrared light has been shown to help transition hair from the telogen phase back to the anagen phase and prolong the anagen/growth phase. It can also increase the rate of growth in the anagen phase while preventing premature catagen phases.

These effects may be mediated by increases in certain growth factors, of effects on inflammation, improved mitochondrial functioning in the cells in that area, or on nitric oxide levels and blood circulation to the area, or some combination of all these factors.

In short, it helps hair stay in the growth phase, grow more, and re-enter the growth phase (instead of dying off). The end result is less hair loss and more hair growth.

Reduce Cellulite with Near-Infrared and Red Light Therapy

Red light therapy has a profound effect on reducing fat layers and eliminating cellulite.

Cellulite is a problem caused by a combination of unhealthy collagen and elastin in the skin layers, combined with excess fat accumulation in the fat cells in that area. (The health of the extracellular matrix likely also plays a role.)

Near-infrared and red light therapy actually combat cellulite in three ways:



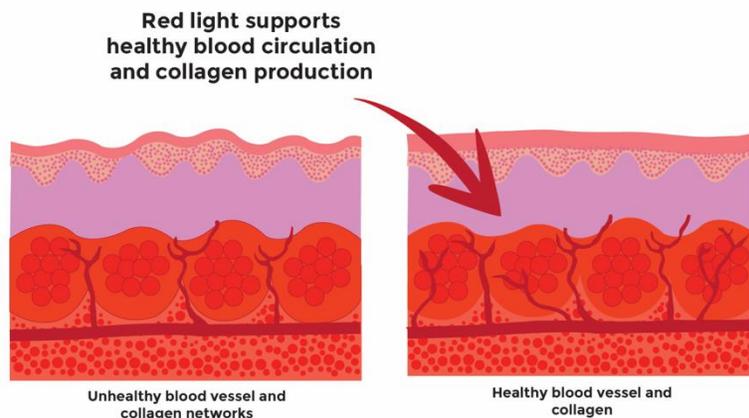
1. By bolstering production of collagen and elastin (and supporting the health of the extracellular matrix – the fibrous support structure around cells).
2. By supporting blood circulation and blood vessel health in the area.
3. By causing fat cells to release their fat contents into the blood where they may be burned off.

One study found that when near-infrared and red light therapy is combined with massage, **it led to an astounding 71%**

reduction in cellulite!⁹²

Another study that assessed the use of near-infrared and red light therapy on skin health found that **“91% of subjects reported improved skin tone, and 82% reported enhanced smoothness of skin in the treatment area.”**⁹³

In fact, this is one of the *only* science-backed ways that has actually been proven to reduce cellulite, and likely the single most powerful way. (Note: Most creams and products sold to reduce cellulite have little to no scientific evidence of effectiveness.)



Red/NIR light support collagen and elastin production, increased blood vessel health and circulation, and potentially, also fat loss in the area – all leading to enhanced skin smoothness and decreased cellulite.

Speed Up Wound Healing with Near-Infrared and Red Light Therapy

Near-infrared and red light therapy are fantastic for wound healing. This was one of the original findings of the NASA research that really put red light therapy on the map. In fact, near-infrared and red light therapy has been found to help close wounds, even wounds resistant to healing, 20% faster and with less scarring. Near-infrared and red light therapy also has proven to reduce the appearance of facial scars.⁹⁴

It also increases circulation and the formation of new capillaries. Increased circulation and the formation of new capillaries means the wounded area receives more of the oxygen and nutrients it needs to initiate and maintain the marvelous healing process. Red/infrared light accomplishes this in several ways:

- cleaning up dead and damaged cells in skin (phagocytosis)
- increasing ATP in skin cells, giving cells more energy to heal themselves
- increasing the production of fibroblasts^{95,96}
- increasing blood flow, supplying the wound more oxygen and nutrients needed for repair
- stimulating the production of collagen and the health of the extracellular matrix⁹⁷
- stimulating lymph activity
- stimulating the formation of new connective tissue and blood capillaries on the surface of the wound. ^{98,99,100,101,102,103,104}

Combat Fibromyalgia and Chronic Fatigue, and Increase Energy Levels with Near-Infrared and Red Light Therapy

Studies show that red light therapy is also effective at restoring energy and vitality in persons suffering with fibromyalgia. Because red light is so effective at reducing inflammation, it is proving effective at treating fibromyalgia, which is partly caused by inflammation in the brain stem/hypothalamus region.^{105,106} This same effect would likely also benefit chronic fatigue syndrome (which shares many of the same symptoms as fibromyalgia), though it has not yet been studied.

Near-infrared and red light therapy is very effective for the treatment of fibromyalgia, for virtually all of the most problematic symptoms that accompany fibromyalgia.

Multiple studies have found that near-infrared and red light therapy offers:

- Enhanced quality of life for fibromyalgia patients
- Decreased pain
- Decreased muscle spasm
- Decreased morning stiffness
- Decreased total tender point number in fibromyalgia cases

Research – including a very recent 2017 study – suggests that this therapy method is a safe and effective treatment for fibromyalgia.^{107,108,109}

Once you understand the pathways through which red/NIR light works its magic on the human body, it actually makes good sense that red/NIR light would benefit chronic fatigue conditions and increase energy

levels. Much research over the last 5 years has suggested that **mitochondrial dysfunction, brain function, and inflammation are at the core of chronic fatigue.** ^{110,111,112,113,114,115} As explained in several other sections in this book, there are hundreds of studies now showing that **red/NIR light therapy has huge benefits to mitochondrial and brain function, and that it powerfully decreases inflammation.** So even though there are only a few studies that have tested this directly thus far, based on a simple understanding of the mechanisms at play and the science that is already known, it is perfectly reasonable to think that red/NIR light has massive potential for helping people struggling with chronic fatigue.

But it's not just "potential!" I've already been using red/NIR light therapy with members of The Energy Blueprint program (which is the system I've developed to help people overcome fatigue) for over 3 years now, and I've had hundreds of people tell me that red/NIR light therapy has been one of the absolute biggest factors in their recovery from chronic fatigue. In short, this stuff really works!

Fight Hashimoto's Hypothyroidism with Near-Infrared and Red Light Therapy

Several studies have shown profound benefits of near-infrared and red light therapy for autoimmune hypothyroidism. This is one of the only treatments that has been shown to potentially reverse (or at least greatly slow the progression of) autoimmune hypothyroidism.

- A recent 2013 randomized, placebo-controlled study in hypothyroid patients demonstrated that in people who got near-infrared light therapy, thyroid function dramatically improved, and remarkably, that thyroid antibody (TPOAb) levels were massively reduced. **Amazingly, 47% of patients were able to stop medication completely!** Moreover, the researchers also followed up 9 months after treatment and found that the effects were still evident!¹¹⁶ They even published a 6-year follow-up, which basically said that even at 6 years, some of the benefits still remained, but periodic sessions were recommended to maintain all benefits.¹¹⁷ (To be honest, I don't suggest red/NIR light as a one-time treatment that is expected to last long-term. For optimal benefits, most research indicates that sessions be done with red/NIR therapy at least once a week consistently.)
- A 2010 study found that red light therapy helped 38% of study participants reduce their hypothyroid medication dose, with **a whopping 17 %being able to stop taking the medication altogether!**¹¹⁸
- A 1997 study done in Russia included some data on people with autoimmune hypothyroidism who underwent a thyroid surgery. They found that red/NIR light therapy improved thyroid hormone levels enough that they required, on average, roughly half as much thyroid hormone medication.¹¹⁹
- A 2003 study done in the Ukraine showed that red light therapy can decrease thyroid medication needs by 50-75% in people with postsurgical hypothyroidism.¹²⁰
- A 2010 Russian dissertation study gave red light therapy on the thyroid gland to a group of people with hypothyroidism and found that 17% of people could completely get off thyroid medication and 38% could decrease the dose by 25-50µg.¹²¹
- A 2014 study used the light therapy for 10 sessions with 347 women with subclinical hypothyroidism. At baseline, the average TSH (thyroid stimulating hormone) was 9.1 mIU/L. (Note: Higher TSH is a sign of hypothyroidism). After ten sessions of light therapy, the TSH was normalized in 337 (97%) of these women. Their TSH averaged at 2.2 mIU/L after just 10 light treatments.¹²²

While more research is still needed, the existing research is very consistent that red/NIR light therapy has profound beneficial effects on thyroid function. It appears to improve thyroid hormone output, increase blood vessel formation (and thus blood flow) in the thyroid gland, and decrease the progression of the condition through beneficial changes in thyroid gland health and immune system modulation.

I don't want to sound hyperbolic, but these effects are astounding! You'd be hard-pressed to find any other type of therapy in existence that shows anywhere close to this level of improvement in hypothyroidism.



Potentially Combat Cancer Growth with Near-Infrared and Red Light Therapy (with caveats)

Since red light tends to enhance energy production in whatever cells it's shined on, it was speculated many years ago that it might actually enhance cancer growth.

For this reason, it's probably **not** a good idea to use red light therapy directly on cancerous tumors. (Though there is some research using it in extremely large doses to actually damage tumor cells,¹²³ it is not worth risking the possibility that exposure directly on the tumor could stimulate growth.)

But, according to Michael Hamblin, PhD, using the light on other areas of the body (not directly on the cancerous growth) will likely improve overall outcomes in people with cancer.¹²⁴

For example, a 2004 phase 1 trial in patients with advanced neoplasia demonstrated that near-infrared and red light therapy was safe for clinical use and improved performance status and quality of life. Antitumor activity was observed in 88.23% of patients and remained so in a 10 year follow-up.¹²⁵

These early results from this 2004 trial, combined with a growing body of research, demonstrate that near-infrared and red light therapy can exert strong antitumor effects^{126,127,128} and are consistent with experimental and clinical reports from multiple studies that near-infrared and red light therapy exerts anti-cancer and anti-tumor effects.^{129,130,131,132} It may also help decrease side-effects of chemotherapy and radiation.

Further studies are needed to confirm that near-infrared and red light therapy is safe and effective for use in treating cancer patients.¹³³

WARNING: I do NOT recommend trying this sort of cancer treatment with red/NIR lights at home – it should only be done under the guidance of a physician who knows the proper dosing and administration of the therapy. Again, let me emphasize that none of this is to be construed as medical advice or as claims to treat or cure any medical condition. As stated above, more research is still needed on this topic. Do not attempt to self-diagnose or treat yourself for any medical condition. The above paragraphs are meant only to educate about experimental research that's been done, not as advice for anyone to treat any condition. If you have any medical condition, follow your doctor's advice.

Increase Bone Healing with Near-Infrared and Red Light Therapy

Studies on animals and humans have found that red and near-infrared light therapy greatly aids in healing breaks, fractures, and bone defects.¹³⁴ ATP production is interrupted in broken bones, and cells begin to die from lack of energy. Red and near-infrared light have been shown to:

- Stimulate energy production in the bone cells¹³⁵
- Increase bone growth factors¹³⁶
- Enhance blood vessel formation and blood flow to the affected area¹³⁷
- Modulate inflammation¹³⁸
- Enhance the attachment and production of collagen and procollagen and stimulates growth of bone cells – all of which accelerate the bone repair process^{139,140}

Overall, bone irradiated with near-infrared wavelengths shows increased bone formation and collagen deposition.¹⁴¹ Red and near-infrared light therapy is becoming very popular in all sports where breaks, sprains, and fractures are frequent — from horse racing to football.

Lower Inflammation (and Potentially Inflammation-Related Diseases) with Near-Infrared and Red Light Therapy

Red and near-infrared light therapy is highly effective in treating chronic inflammation. It suppresses inflammation and production of inflammatory cytokines, and dramatically reduces inflammation throughout the body.

Since chronic inflammation is now being recognized as a major contributor to **most chronic diseases** from heart disease, depression, and cancer, to Alzheimer's and chronic fatigue syndrome, this effect of red light therapy on inflammation is a very big deal.

Many aging scientists now speak of "inflamm-aging"¹⁴² — the concept that the genes and pathways that control inflammation may very well be the key drivers of aging and disease.

Red light has shown to decrease inflammation wherever mitochondria are present – from the tissues to the joints and other specific organs of the body. Recent studies are exploring the possibilities of using red light therapy to treat autoimmune diseases which originate in inflammation, such as lupus and multiple sclerosis.¹⁴³ Near-infrared and red light therapy has been used with positive effects in autoimmune diseases such as rheumatoid arthritis¹⁴⁴ and Sjogren's syndrome.¹⁴⁵

Studies have even shown that red/NIR light therapy can have anti-inflammatory effects on par with non-steroidal anti-inflammatory drugs (NSAIDs),¹⁴⁶ which are the anti-inflammatory drugs routinely prescribed and typically, the over-the-counter drugs people buy when in pain. (It's important to mention that chronic use of these drugs comes with a big risk of side effects).

In general, near-infrared and red light therapy powerfully downregulate the body's inflammatory pathways. This has profound implications for its potential role in disease prevention and longevity.

Improve Eye Health with Near-Infrared and Red Light Therapy

Research into the benefits of near-infrared and red light therapy for eye health is very promising. Studies on animals show that red light therapy can heal damage to eyes from excessive bright light in the retina. This kind of damage is similar to the damage that occurs in age related macular degeneration (AMD).¹⁴⁷

One human study in patients with AMD showed that red light therapy improved vision, and that improvements were maintained for 3-36 months after treatment. It also appeared to improve edema, bleeding, metamorphosis, scotoma and dyschromatopsia in some patients.¹⁴⁸

Note: The eyes are sensitive tissues, and as such, for any self-use of light therapy, I suggest shorter sessions at an increased distance away from the light. And as always, for any medical conditions, consult your physician rather than attempting to self-treat.

Combat Depression and Anxiety with Near-Infrared and Red Light Therapy

We know that bright light therapy and light boxes have shown great promise in treating seasonal affective disorder and depression. What about red light and near-infrared light therapy?

Although large randomized studies on using humans are still needed (two major studies are currently in progress), early research regarding the use of near-infrared and red light therapy for treating depression and anxiety disorders is very promising.

In a recent review of all existing studies on near-infrared and red light therapy and depression/anxiety disorders, researchers found that these light therapies offer a "promising treatment" for major depressive disorder, suicidal ideation, anxiety, and traumatic brain injury.¹⁴⁹

Several studies have indicated that people with depression have abnormal blood flow in the frontal cortex of the brain. Since red/NIR light improve blood flow and circulation to the brain, it is reasonable to believe that could be part of the mechanism at play.^{150,151}

Note: For treating the brain, it is likely that near-infrared will be superior to red light, as it penetrates more deeply. Specifically, research has shown that it penetrates the skull better than red light.¹⁵² We'll talk more in detail later for which scenarios it's better to use red or near-infrared, depending on what you are trying to do. But in this case, for any brain-related issues, near-infrared is generally superior.

A 2009 study **took 10 patients with a history of major depression and anxiety** (including PTSD and drug abuse) and gave them four weeks of treatments to the forehead with red/NIR light. Remarkably, by the end of the four-week study, 6 out of 10 patients experienced a remission of their depression, and 7 out of 10 patients experienced a remission of their anxiety.¹⁵³

Though further research is needed, there have been 10 studies so far on the use of red and near-infrared light therapy to treat depression and anxiety related disorders with 9 of 10 studies yielding very positive results.^{154,155,156,157,158,159,160,161}

Researcher Julio Rojas, MD, PhD has stated "The data supports that LLLT to the head constitutes a promising neurotherapeutic tool to modulate behavior in a non-invasive manner."¹⁶²

Improve Cognitive Performance with Near-Infrared and Red Light Therapy

One aspect of human health that red light therapy almost always improves, is cognitive performance. It not only improves the metabolic pathways but also enhances the health of mitochondria in the brain. Since the brain is incredibly rich in mitochondria, this is where people often notice effects the most.

In studies, researchers have found that transcranial near-infrared and red light therapy profoundly benefits the brain and cognitive performance.¹⁶³ Research has also shown that transcranial near-infrared stimulation has been found to increase neurocognitive function in young healthy adults,¹⁶⁴ finding that it improved sustained attention and short-term memory retrieval in young adults, and improved memory in older adults with significant memory impairment at risk for cognitive decline.¹⁶⁵

Another study found near-infrared and red light therapy also increased executive cognitive function in young healthy adults, providing hope that further studies find that near-infrared and red light therapy may provide a hopeful treatment in the fight against Alzheimer's disease, as well as prevention.¹⁶⁶

Help Tendonitis with Near-Infrared and Red Light Therapy

One of the most common uses for red and near-infrared therapy in clinics is for injuries and tendonitis. Because red light stimulates collagen production, speeds wound healing, and is highly anti-inflammatory, it has been shown to bring great relief to people suffering from tendinopathy and tendonitis.^{167,168}

A systematic review of the research concludes that near-infrared and red light therapy has proven highly effective in treating tendon disorders in all 12 studies conducted.¹⁶⁹

Red light therapy exerts positive effects on tendon disorders by modulating inflammation, improving energy production and increasing growth of tendon cells, while stimulating collagen production – all of which act to improve tendon healing processes.¹⁷⁰

Increase Fertility with Near-Infrared and Red Light Therapy

Some research suggests that red light therapy may be useful for fertility, which is making quite an impact upon couples trying to conceive.

A growing number of studies have shown that near-infrared and red light therapy may significantly boost pregnancy rates, even in women who have been unsuccessful with other assisted reproduction treatments, such as in vitro fertilization (IVF).

Near-infrared and red light therapy improves fertility, even in older women, by boosting ATP production in eggs, profoundly improving their viability.

It also improves follicular health, which are highly vulnerable to oxidative stress. Two recent studies, one in Japan and one in Denmark, found that near-infrared and red light therapy improved pregnancy rates where IVF had previously failed, in Denmark, by 68%.¹⁷¹

In Japan, **near-infrared and red light therapy resulted in pregnancy for 22.3% of severely infertile women with 50.1% successful live births.**¹⁷²

As mentioned previously, the testicles also have photoreceptors that respond to red light, and research shows that near-infrared and red light therapy can greatly enhance sperm motility and therefore, fertility.^{173,174}

In studies on human sperm, near-infrared light therapy at 830 nm produced significant improvements in sperm motility.¹⁷⁵

Why does near-infrared and red light therapy enhance sperm motility outside of the body? The tails of spermatozoa are comprised of a string of mitochondria, therefore improving their mitochondria increases their ability to “swim” upstream and enhances their viability.

Given that red light boosts mitochondrial function, it should be of little surprise that it boosts ATP production of the mitochondria in the sperm and testosterone producing cells of the testes as well, thus leading to improved sexual function, and sperm viability.

So red/NIR light therapy can be a powerful tool for both men and women trying to conceive.

One caveat for men: Never use any type of red light therapy that gets hot, like red heat lamps, near your testicles, as that could damage fragile Leydig cells. In fact, let me make three things very clear about applying light to the testicles:

- Avoid heating the testicles, heat damages sperm cells and negatively impacts the Leydig cells.
- Avoid blue light on the testes (blue light inhibits the production of ATP — thus decreasing, not promoting, mitochondrial health).
- Avoid any infrared heat lamps and infrared bulbs on the testes – these emit far too much heat to be used.
- I recommend low dose red light therapy in general, as the testes may be especially sensitive to overdoing sessions. Don't overdo it –small doses only.

Note: Some people in the red light business and biohacking communities have made some claims around the capacity of red light therapy to increase testosterone levels. While I was initially excited about this, upon exploring the research that was cited in support of this, I have concluded that the evidence is simply not strong enough to support these claims. The claims are based mostly on one study in rats, which wasn't an impressive study – it only showed elevations in testosterone briefly on one day, before returning to normal.¹⁷⁶ It also didn't show testosterone elevation for the group using near-infrared (only in the group using red light). The study did use very high doses (far too high, in my opinion) and it's possible that a more reasonable dose could lead to benefits for testosterone levels. However, other studies have failed to show similar benefits.^{177,178} I remain open to the possibility that red/NIR light may increase testosterone levels when used on the testes, but the evidence for it as of this writing (2018) is not sufficient. That said, there is some intriguing research on the ability of sun exposure and vitamin D to boost testosterone levels, and that seems a safer bet for now.^{179,180}

While the research on boosting testosterone is not strong, there is an abundance of solid evidence for the ability of red/NIR light therapy to improve fertility.

Improve Joint Health and Combat Arthritis with Near-Infrared and Red Light Therapy

Studies have also shown that near-infrared and red light therapy can help people with osteoarthritis (often called just “arthritis”).^{181,182,183} It does this through four primary mechanisms:

- Decreasing pain¹⁸⁴
- Modulating inflammation (decreasing pro-inflammatory cytokines) and increasing anti-inflammatory cytokines)¹⁸⁵
- Increasing circulation to the area¹⁸⁶
- Stimulating wound healing and cellular repair mechanisms in the damaged joint itself¹⁸⁷

It’s worth noting that there have been some mixed reports in the data about the effectiveness of red/NIR light therapy for osteoarthritis. Here’s what Michael Hamblin, PhD wrote in his 2013 review of the scientific literature on this subject:

“LLLT has been used clinically in osteoarthritis for many years but is still considered controversial. Although a Cochrane review reported mixed and conflicting results, a subsequent analysis conducted by Bjordal and colleagues concluded that the Cochrane review conclusion was neither robust nor valid. Further sensitivity analyses with inclusion of valid non-included trials, performance of missing follow-up, and subgroup analyses **revealed consistent and highly significant results in favor of active LLLT for osteoarthritis.**”¹⁸⁸

In short, while some published studies apparently failed to find positive results, a more detailed review of the research showed that red/NIR light does in fact have powerful benefits for osteoarthritis. Given its capacity to decrease inflammation, kill pain, and increase connective tissue growth, this finding is exactly what we would expect.

Decrease Diabetes Symptoms with Near-Infrared and Red Light Therapy

For diabetics, the most positive results gleaned from studies on the effects of near-infrared and red light therapy for healing is healing foot ulcers. Historically, these are harder to heal due to poor circulation and high glucose levels, especially in the lower limbs. Studies in animals and humans reveal that red light therapy helps restore diabetic patients’ normal healing ability by exerting a stimulatory effect on the mitochondria with a resulting increase in adenosine triphosphate (ATP).^{189,190,191,192}

Red light therapy also has had profound success in helping patients with painful diabetic neuropathy. Studies have found that near-infrared and red light therapy also helps to relieve pain and improve nerve function and foot skin microcirculation in diabetic patients.^{193,194,195,196}

Improve Oral health with Near-Infrared and Red Light Therapy

Red light therapy and near-infrared light therapy have proven to have numerous benefits for oral health and research in this area is booming right now. So far, studies indicate promising results for near-infrared and red light therapy, which has been shown to:

- Combat viral and bacterial infections of the mouth (tonsillitis, herpes, cold sores)^{197,198,199}
- Reduce mouth pain²⁰⁰
- Facilitate tooth growth/tooth movement and reduce pain for individuals with corrective braces^{201,202,203}
- Help diabetics with gum problems and periodontal disease^{204,205,206}
- Reduce thrush (yeast in the mouth/candidiasis)^{207,208}
- Improve tooth sensitivity^{209,210}
- Fight gum disease and gingivitis^{211,212,213}

Hamblin et al. note that red/NIR light therapy can be used with a huge variety of dental procedures to improve outcomes and speed healing.²¹⁴

Improve Respiratory Health with Near-Infrared and Red Light Therapy

In studies, near-infrared and red light therapy has been shown to improve the health of those who suffer from chronic respiratory diseases such as asthma, COPD, bronchiectasis, and ILD,^{215,216,217,218} as well as patients suffering from chronic obstructive bronchitis.²¹⁹

Red light therapy has also proven to decrease lung inflammation in rodents after exposure to toxins and common indoor air pollutants, such as formaldehyde.²²⁰

Improve Heart Health with Near-Infrared and Red Light Therapy

So far there have only been animal studies on red light therapy's benefits for heart health and heart repair after cardiac events and surgery. In a recent systematic review (2017) of the scientific literature, scientists found that animal studies reveal consistently positive effects of red light therapy by reducing infarct size (the size of the damaged area in heart attacks) up to 76%, decreasing inflammation and scarring, and accelerating tissue repair.

In heart tissue studies, near-infrared and red light therapy works through multiple molecular pathways, including modulation of inflammatory cytokines, signaling molecules, transcription factors, enzymes and antioxidants.²²¹ Other studies have noted many other benefits to heart function.^{222,223,224,225,226,227}

Improve Liver Function with Near-Infrared and Red Light Therapy

The study of red light therapy to enhance the health of the liver is still in its infancy. So far, only animal studies have been done. However, in these studies, near-infrared and red light therapy yields very positive results for healing cirrhotic livers in rodents²²⁸ as well as in surgical applications, such as to enhance regeneration of the liver during liver transplants.²²⁹

Increase Pancreas Health with Near-Infrared and Red Light Therapy

So far, there have been very few studies done on this organ with near-infrared and red light therapy. However, in human and animal studies conducted so far, near-infrared and red light therapy has proven to enhance islet cell function before transplantation,²³⁰ and to stimulate regeneration of islets and ducts in experimental models of diabetes.²³¹

Decrease Pain with Near-Infrared and Red Light Therapy

Near-infrared and red light therapy has been remarkably effective at reducing joint pain in virtually all areas of the body.

There are a number of proposed mechanisms (that have some evidence to support them) for exactly how red/NIR light works to combat pain: changes in tissue opioid receptors, changes in substance P, and interference with nerve transmission and pain sensation.^{232,233}

It's worth noting that there are different types of pain that are caused by different things. Red/NIR light therapy almost certainly does not work equally well for all types of pain, regardless of location and cause of the pain. For that reason, not all studies on various types of pain have shown benefit. The most recent 2014 review of the scientific literature noted:

"Studies have demonstrated that LLLT may have positive effects on symptomology associated with chronic pain; however this finding is not universal. A meta-analysis utilizing 52 effect sizes from 22 articles on LLLT and pain from Fulop et al. (2010) demonstrated an overall effect size of 0.84. This would be classified as a large effect size and suggests a strong inclination for the use of LLLT to reduce chronic pain."²³⁴

Here are several conditions where red/NIR light has proven effective:

- Chronic neck pain^{235,236}
- Knee pain²³⁷
- Fibromyalgia
- Low back pain²³⁸
- Chronic pain in the elbow, wrist and fingers²³⁹
- Chronic joint disorders²⁴⁰
- Sacroiliac joint pain²⁴¹

- Chronic tooth pain^{242,243}
- Osteoarthritic pain²⁴⁴
- Tendinitis and myofascial pain²⁴⁵

So while not every study has shown benefit for every type of pain condition, the overwhelming bulk of evidence suggests that red/NIR light can at least be moderately helpful for most types of pain.

In a recent systematic review, researchers concluded that red light therapy has proven “beneficial for many individuals suffering from pain, regardless of the condition that is causing it.”²⁴⁶

Improve Immunity with Near-Infrared and Red Light Therapy

In numerous studies, red/NIR light therapy has proven to benefit the immune system.

In animal studies, near-infrared and red light therapy has a boosting effect on the immune system of immune-deficient cancer-inoculated animals, resulting in an increased lifespan.²⁴⁷

In human studies, near-infrared and red light therapy also boosted the immune systems and T cells of preoperative cancer patients without increasing tumor size.²⁴⁸ (Researchers have expressed hope that these exciting results may mean a form of safe treatment for immunodeficiency diseases in humans.)

In the context of wound healing, it has also been shown to have beneficial effects, in part by modulating immune function.²⁴⁹

One review of the scientific literature noted:

“Immune cells, in particular, appear to be strongly affected by LLLT. Mast cells, which play a crucial role in the movement of leukocytes, are of considerable importance in inflammation. Specific wavelengths of light are able to trigger mast cell degranulation, which results in the release of the pro-inflammatory cytokine TNF-a from the cells. ... Lymphocytes become activated and proliferate more rapidly, and epithelial cells become more motile, allowing wound sites to close more quickly. The ability of macrophages to act as phagocytes is also enhanced under the application of LLLT.”

Another study found that red/NIR light therapy to the bone marrow could increase the platelet count and help resolve low blood platelets caused by chemotherapy or by an autoimmune disease.^{250,251}

It also appears to selectively modulate cell function in some types of infected cells while not affecting healthy uninfected cells in the same way.²⁵²

In vitro studies on human leukocytes have shown that near-infrared light can increase activity of these immune cells. Given that we know red/NIR light penetrates our blood vessels and irradiates our bloodstream, it is reasonable to think may also happen internally.^{253,254}

A fascinating study in mice looked at shining red light on the thymus gland (an important gland in the immune system) and on an area of a back leg. They found that the mice who received the treatment on the thymus gland area (in the center of the chest) had more profound changes in immune cell function.²⁵⁵ (They also noted that overdoing the dose could have immunosuppressive effects, which is consistent with what is known in every other context – you can overdo the dose. We’ll talk more about this in a later section on the “biphasic dose response.”) Another remarkable and more recent study from December 2017 looked at the potential for red/NIR light to reverse “thymic involution.” What the heck is “thymic involution,” you ask? As we get older, our thymus glands “involute” – they basically shrivel up and become much less functional, which has a negative impact on our immune function. This study suggests

that red/NIR light may be able to slow or even reverse this “thymic involution” – thus keeping our thymus gland function and immune function in tact as we age.²⁵⁶ The researchers concluded “This perspective puts forward a hypothesis that PBM [photobiomodulation] can alter thymic involution, improve immune functioning in aged people and even extend lifespan.”²⁵⁷

Another fascinating study looked at the influence of red light therapy on people with treatment-resistant schizophrenia and found symptomatic improvement in a large portion of people. They also found pronounced improvement in immunological markers.²⁵⁸

As discussed in the section on thyroid health, in people with Hashimoto’s – a common autoimmune condition responsible for most hypothyroidism – red/NIR light has proven to have remarkably beneficial effects on immune function.²⁵⁹ Another animal model of multiple sclerosis (another autoimmune condition that degenerates the fatty sheath around nerves that helps nerve conduction) showed that just two treatments done over a span of 14 days led to significant improvement with less brain cell death and slowed the progression of the disease.²⁶⁰ Other animal studies have found similar effects:

“Finally, histological analysis showed that LLLT blocked neuroinflammation through a reduction of inflammatory cells in the CNS, especially lymphocytes, as well as preventing demyelination in the spinal cord after EAE induction. Together, our results suggest the use of LLLT as a therapeutic application during autoimmune neuroinflammatory responses, such as MS.”²⁶¹

As you can see, it doesn’t just appear to increase immune activity – but to also beneficially modulate immune activity, regardless of whether one currently has underactive or overactive (or otherwise imbalanced) immune activity.

Overall, the body of research looking at immune function in different conditions paints a more complex picture than simply that red/NIR light either stimulates or inhibits immune function. While I’m sure we’ll find exceptions to this rule as more studies are done, red/NIR light seems to be an “immune nutrient” that supports *optimal* immune function in a wide variety of different scenarios and health conditions. It seems to be able to positively affect immune function in the right direction, potentially, regardless of whether someone has low immune function during an infection or has an overly active and imbalanced immune system due to autoimmune disease.

Help Heal Traumatic Brain Injury (TBI) and Spinal Cord Injury with Near-Infrared and Red Light Therapy

Red light therapy is bringing recovery and enhanced cognition to those suffering from traumatic brain injury. Patients who have suffered TBI report improved cognition, better sleep, and enhanced recovery from the traumatic experience of their accident.^{262,263}

In animal research, near-infrared and red light therapy has impressive outcomes in recovery of animals after stroke. Scientists believe the therapeutic effects stem largely from increased mitochondrial function (i.e. increased ATP production) in brain cells irradiated with near-infrared and red light therapy.^{264,265,266}

Spinal cord injuries cause severe damage to the central nervous system with no effective known restorative therapies. However, near-infrared and red light therapy has been found to accelerate regeneration of the injured peripheral nerve and increase the axonal number and distance of nerve axon regrowth, while significantly improving aspects of function toward normal levels. Numerous studies

indicate that near-infrared and red light therapy is a promising treatment for spinal cord injury that warrants full investigation.^{267,268,269,270}

Improve Stem Cell Therapy with Near-Infrared and Red Light Therapy

There have been wonderful results in both human and animal studies where infrared light has been used in conjunction with stem cell implantation, and potentially in activating the body's own stem cells. Bone marrow stem cell transplantation depends upon the survival and colonization of the new stem cells that have been transplanted. So far, research has found that "Red or near-infrared light from 600–1,000nm (red and near-infrared) promotes cellular migration and prevents apoptosis" – meaning, it helps promote cell growth and prevent cell death in the newly transplanted cells.²⁷¹ Red light therapy also increases stem cell growth and promotes cell proliferation without the creation of excessive ROS (free radicals).^{272,273}

Researchers have also found that near-infrared and red light therapy can help repair heart tissue after a heart attack.²⁷⁴ In a recent study, Professors Oron et. al. shined red laser lights onto the bone marrow cells of heart attack patients and found that "After a low-level laser was 'shined' into a person's bone marrow -- an area rich in stem cells -- the stem cells took to the blood stream, moving through the body and responding to the heart's signals of distress and harm. . . Once in the heart, the stem cells used their healing qualities to reduce scarring and stimulate the growth of new arteries, leading to a healthier blood flow."²⁷⁵ Studies like Oron's are giving scientists hope that near-infrared and red light therapy can be used to make stem cell therapy easier and more effective in a wide range of surgeries, and even aid in the repair of other organs, such as the liver and kidneys. Overall, near-infrared and red light therapy has proven to speed internal wound healing, cell regeneration, cell proliferation, promote cellular migration and prevent development of ROS and apoptosis (cell death).^{276,277,278,279,280,281,282,283,284,285,286,287,288} It is very possible – likely in fact – that part of the healing mechanisms at play are activation of stem cells.

Hopes are high for transplant patient, bone marrow recipients, and patients recovering from organ failure and degeneration of all kinds.

Heidi Abrahamse assessed the potential of red light therapy combined with stem cell therapy, noting that

"... by combining regenerative medicine, stem cell therapy and (red light therapy), the numbers and patients [receiving transplants and regenerative therapy] will increase, the applications will expand, and, therefore, the quality of life of millions of people may be improved. Regenerative medicine has the ability to transform the treatment of human disease by introducing combined, innovative new therapies such as stem cell and (red light therapy) that offer faster, complete recovery and reduce the risks of donor organ transplantation rejection through autologous grafts seem harder to believe than what it is possible."²⁸⁹

Abrahamse adds that these new discoveries of near-infrared and red light therapy's powers to enhance transplant and regenerative surgery to the point that "Revitalizing or replacing worn-out or diseased body tissue and organs in a 'made to order' may well be in our near future."²⁹⁰

Fall Asleep Faster and Improve Sleep Quality

There is some research suggesting that red/NIR light can impact melatonin. Melatonin is a hormone produced primarily by the pineal gland in the brain, and even most non-scientists are somewhat familiar with melatonin for its role in promoting sleep. Interestingly, based on a few studies done in China, red/NIR light seems to increase melatonin produced by the body! Even more interestingly, it seems that

this increased melatonin production comes from other parts of the body other than the pineal gland! **The studies found increased melatonin in blood circulation following red/NIR light exposure, and studies have also found dramatic benefit to sleep in people with insomnia.**^{291,292,293} (Note: The studies used intranasal light specifically, but there is no logical reason to believe that light in the nose is necessary for this effect – it is likely from irradiating the bloodstream or the skin, or both.)

Here is a quick summary of the relevant research from Lew Lim, the founder of VieLight:

- The first documented use of a similar intranasal light therapy device to directly observe melatonin level was conducted by Xu C et al in 2001. They treated 38 subjects that had insomnia with intranasal low level laser therapy once a day over 10 days. They found that serum melatonin had increased.
- The same group of researchers further treated another group of 128 patients with insomnia and found that the polysomnogram (sleep study that includes data on brain waves as electrical activity) data had improved.
- In 2006, Wang F et al reported that they had treated 50 patients with insomnia with intranasal low level laser therapy that is of similar specifications to VieLight's laser device for 60 minutes per session. Each session was conducted once a day over between 10 to 14 days. They found that the condition had **improved significantly in 41 (82%) of the cases, mild for 4 (8%) of the cases, and none for 5 (10%) of the cases.**
- Traditional Chinese Medicine practitioners often prescribe herbs as remedy for insomnia. This seems to help somewhat. Chen YM et al tested 90 patients and found that that the condition improved significantly for 40% of the cases, mild for 37.5% and none for 22.5% of the cases. In the group that added the extra element of the intranasal low level laser therapy, the improvement in the number of positive results were significantly more impressive. **78% of the patients experienced significant improvement, 20% mild and 2% none.**^{294,295,296,297}

More research is still needed on this topic. But I also want to mention that I have experimented with this heavily with my Energy Blueprint program members and the reports I get from people who try it line up perfectly with the research – it just flat-out works, in a very noticeable and powerful way for many people.

There is one more thing I want to add about melatonin...

Most people know melatonin as a sleep-inducing hormone. And it is certainly that.

But most people have no idea that melatonin is imperative for mitochondrial function, protects mitochondria from damage, and is vital for mitochondrial regeneration while we sleep.

Evolutionary side note: It is interesting to think that maybe our bodies are wired to benefit from sitting next to a fire for several hours each night, as many of our ancestors did. Perhaps the red and near-infrared light emitted from the fire actually benefits us at the cellular level, partly because of the impact it can have on melatonin production and sleep enhancement. Some researchers have suggested that many of the health benefits of red/NIR light therapy may have to do with the effect on melatonin levels.²⁹⁸)

There are a number of impressive – and little known – studies showing how vital it is for mitochondrial health that you produce adequate melatonin each night. Melatonin benefits our mitochondria in numerous ways, including:

- Preventing free radical damage directly in the actual mitochondria^{299,300} (which is very unique to melatonin since virtually all other "antioxidants" cannot do this).

- Regulation of mitochondrial bioenergetic function and maintaining respiratory complex activities, electron transport chain, and ATP production in mitochondria.³⁰¹
- Acting as a neuroprotectant in the brain, preventing the kind of oxidative stress/nitrosative stress-induced mitochondrial dysfunction seen in experimental models of Parkinson's, Alzheimer's, and Huntington's disease.³⁰²
- Potentially slowing aging.³⁰³

And remember, mitochondrial health is critical to not only our energy levels, but poor mitochondrial health is also implicated in numerous diseases and even aging itself.³⁰⁴ So the fact that red/NIR light supports melatonin production may have far-reaching benefits to us for increasing energy levels (and preventing fatigue), slowing aging, and preventing disease.

Improve Brain Health, and Slow Progression of Alzheimer's and Parkinson's Disease with Near-Infrared and Red Light Therapy

Near-infrared and red light therapy is having a *profound impact* in diseases and conditions of the nervous system of all kinds from traumatic brain injury, to spinal cord injury, peripheral nerve injury, painful diabetic neuropathy, and has potential to help reverse Alzheimer's and Parkinson's disease, and may potentially contribute to delaying and/or halting them if caught early enough.³⁰⁵

Red and near-infrared light have been shown to:^{306,307,308,309,310}

- Benefit cognitive performance and memory
- Improved mitochondrial function of brain cells
- Have a protective effect on neurons
- Improve cellular repair of neurons
- Increase brain-derived neurotrophic factor (BDNF) and nerve growth factor (NGF)
- Decrease brain inflammation (decreased pro-inflammatory cytokines and increased anti-inflammatory cytokines)

Recent studies have now found that near-infrared and red light therapy may significantly slow the progression of Alzheimer's and Parkinson's disease.^{311,312}

Although still in its infancy, scientists are hopeful that near-infrared and red light therapy may offer a new way to halt or reverse Parkinson's and Alzheimer's or halt progression of these conditions if caught early enough. Alzheimer's is, at least in part, caused by mitochondrial damage or dysfunction, which reduces ATP production and contributes to neuronal death. This process leads to an increase in toxic reactive oxygen species, generating oxidative stress and subsequent neuronal death, as observed in Alzheimer's disease.^{313,314,315,316}

Although researchers are still unclear as to the exact way that near-infrared-induces its neuroprotective effects, they believe it operates by:

1. Activating healing intracellular cascades that result in the survival of target and surrounding cells
2. Spurring neurogenesis (growth and birth of neurons in the brain) through increases in BDNF, for example
3. Triggering systemic protective mechanisms

As researchers note,

"...with the bulk of results still at the pre-clinical 'proof of concept' stage, near-infrared therapy has the potential to develop into a safe and effective neuroprotective treatment for patients with Alzheimer's and Parkinson's disease (and presumably other neurodegenerative diseases such as multiple sclerosis and amyotrophic lateral sclerosis). If near-infrared was applied at early stages of the disease process, for example at first diagnosis, it could potentially slow further progression by protecting neurons from death. Consequently, over time, the greater neuronal survival would lessen the clinical signs and symptoms. Further, near-infrared therapy — because of its lack of side-effects and neuroprotective potential — is amenable to use in conjunction with other treatments."³¹⁷



In short, near-infrared light (because it penetrates the skull better than red light), appears to be a promising therapy for neurological conditions and improving brain health.

Enhance Muscle Gain, Strength, Endurance, and Recovery with Near-Infrared and Red Light Therapy

*"Sports medicine will benefit from PBM [photobiomodulation] because both professional and amateur athletes can better recover from intense exercise, and the process also aids training regimens. In the near future, sport agencies must deal with 'laser doping' by at least openly discussing it because the aforementioned beneficial effects and the pre-conditioning achieved by laser and LED irradiation will highly improve athletic performance."*³¹⁸

– Michael Hamblin, PhD

Red/NIR light with exercise makes a potent combination. Not only does red/NIR light help you recover faster, it seems to amplify everything that happens with exercise – increased muscle gain, fat loss, performance, strength, and endurance.

Studies show that both near-infrared and red light therapy can powerfully repair muscle tissue and help people perform better. It also helps the body get more benefits from exercise – both in terms of muscle gain and fat loss.^{319,320, 321}

There is also research (albeit from animal studies) showing that near-infrared and red light may help prevent muscle loss that occurs with aging.^{322,323}

Muscle tissue has more mitochondria than almost any other tissue or organ in the human body. So muscle tissue is particularly responsive to near-infrared and red light therapy. **The muscles are packed with**

mitochondria, because ATP is needed for every muscle twitch and movement, no matter how insignificant.

Through their effect on ATP production and cellular healing mechanisms, red/NIR light help individuals to recover more quickly from strenuous and resistance exercise, and even helps to prevent muscle fatigue *during exercise*.³²⁴

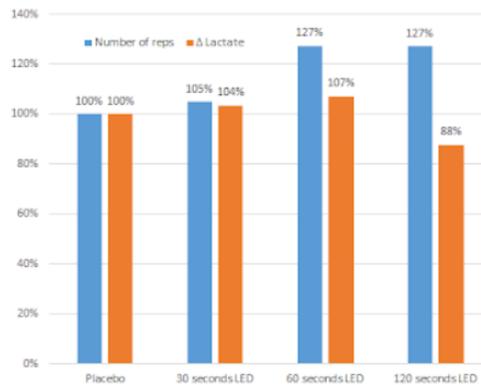
Studies provide evidence that near-infrared and red light therapy powerfully help prevent muscle fatigue, enhance muscle strength and endurance, increase fat loss responses from exercise, increase muscle growth responses from exercise, and promote faster recovery.^{325,326,327,328,329,330,331,332,333} Not too shabby for one simple treatment that takes only a few minutes, right?

How does red and near-infrared light affect muscles – what is it actually doing to cause these benefits? It works through several important mechanisms in the body:

- Red and near-infrared light help promote the production of internal antioxidants by your cells, which prevents oxidative stress and damage to the muscle tissue (when light is applied before exercise).^{334,335}
- Red and near-infrared light help reduce inflammation that will lead to cellular damage (and fatigue) in the muscle tissue as well.^{336,337}
- Protect damaged muscles from secondary damage from further exercise.
- Pre-conditioning: By using the light prior to exercise, it creates a “pre-conditioning” effect where the muscle cells suffer less damage from the exercise, as well as display higher strength/stamina in subsequent exercise following the initial bout of exercise.
- Red and near-infrared light decrease lactic acid production by muscles.
- Red and near-infrared light improve mitochondrial function during exercise.
- Increases acetylcholine receptors on muscles (this is the neurotransmitter released from nerve cells that stimulates muscle contraction).
- Red and near-infrared light increase the production of specific types of heat shock proteins that protect cells from oxidative damage, stress, and apoptosis (early cell death).³³⁸
- Red and near-infrared light also enhance muscle growth, as well as increasing strength significantly.³³⁹
- Red and near-infrared light therapy promotes the development of muscle stem cells, myosatellite cells, which develop into specific varying types of muscles.
- Red and near-infrared light also have the profound benefit of increasing mitochondrial adaptations and mitochondrial biogenesis (the creation of new mitochondria) following exercise.³⁴⁰

To get into some of the research on this topic:

- One study looked at the number of reps that 34 athletes were able to perform on a leg extension weighted exercise as well as the amount of lactic acid their muscles produced, in placebo treatment (sham red/NIR light therapy) vs. 30, 60, or 90 seconds of real red/NIR light therapy. After receiving 60 or 120 seconds of light therapy, **the number of reps the athletes were able to perform went up by 27%**. And in the group that received 120 seconds of light therapy, **their lactic acid levels were also significantly lower** – indicating less muscle strain while actually performing better.³⁴¹



This graph shows the improvement in number of reps performed (blue) with 60 seconds of light therapy, and the improvement in both reps performed and lactic acid levels (red) with 120 seconds of light therapy prior to exercise.

- Another study by Vieira et al. examined levels of fatigue in leg muscles after endurance exercise and found that using light therapy immediately following **significantly reduced fatigue scores** relative to the control group. The researchers concluded "The results suggest that an **endurance training program combined with LLLT leads to a greater reduction in fatigue than an endurance training program without LLLT**. This is relevant to everyone involved in sport and rehabilitation."³⁴²
- Leal-Junior et al. performed a review of the relevant research in 2015 to examine the effects of phototherapy on exercise performance and recovery. They compiled data from thirteen randomized control trials and examined the number of repetitions and time until exhaustion for muscle performance, as well as markers of exercise-induced muscle damage. **The researchers concluded that pre-conditioning the muscles with red/NIR light (i.e. using the light prior to exercise) improves muscular performance and accelerates recovery.**³⁴³
- Another study looked at use of LED red/NIR therapy lights in male athletes who performed 3 intense bouts of exercise on a stationary bike. The **athletes who were given the LED light therapy prior to the exercise had significantly lower levels of creatine kinase (a marker for muscle damage)** compared to the sham light therapy (placebo) group.³⁴⁴
- A recent 2016 review of 16 studies by Nampo et al.³⁴⁵ looked at research using both laser and LED therapy on exercise capacity and muscle performance of people undergoing exercise compared to placebo/sham treatments. They found an **average improvement of 3.51 reps, a 4 second delay in time to exhaustion (i.e. people were able to exercise longer before exhaustion), increased peak strength, and a significant reduction in lactic acid production.**
- A review of research by Borsa et al. found that studies consistently show that **red/NIR light done prior to weight training improved performance and decreased muscle damage.**³⁴⁶
- Another double-blind study (that means that neither the researchers nor subjects know who is getting the real treatment and who is getting the placebo) with 22 non-exercising people were subjected to exercise on a treadmill until exhaustion. **The group that received the light therapy for 30 seconds before exercise had significantly lower levels of creatine kinase and lactate dehydrogenase (LDH) – both markers of muscle damage – suggesting that the light therapy decreased the level of muscle damage.**³⁴⁷
- Another study compared red/NIR light therapy with LEDs to cold water immersion (e.g. ice baths) as a recovery method after exercise and found that **red/NIR light improved recovery more than ice baths**. The researchers concluded: "We concluded that treating the leg muscles with LEDT 5 min after the Wingate cycle test seemed to inhibit the expected post-exercise increase in blood lactate levels and CK activity. This suggests that LEDT has better potential than 5 min of CWIT [cold water immersion therapy] for improving short-term post-exercise recovery."³⁴⁸ This is notable for another reason: Ice baths have been found to accelerate recovery, but at the same

time, they have been shown to hinder some adaptations to exercise such as muscle growth, whereas red/NIR light therapy accelerates recovery while also *amplifying* (rather than hindering) adaptations to exercise. So all in all, red/NIR light therapy would appear to be a superior recovery method compared to the typical ice baths that many athletes engage in.

- A 2015 study by Baroni et al.³⁴⁹ looked at 30 healthy males who were randomized into 3 groups:
 1. Control group – remained sedentary
 2. Training group (TG) – did an 8-week exercise program
 3. Training + light therapy (TLG) – did the same 8-week exercise program plus also did a light treatment (total dose of 240J) using a near-infrared light (810nm wavelength) before each training session.

What happened?

- The training group improved strength by about an average of 14% while the group that included light therapy improved by nearly 25%.³⁵⁰
- The training group improved muscle size of the quadriceps muscles by about 10% while the group that included light therapy nearly *doubled* that improvement!³⁵¹

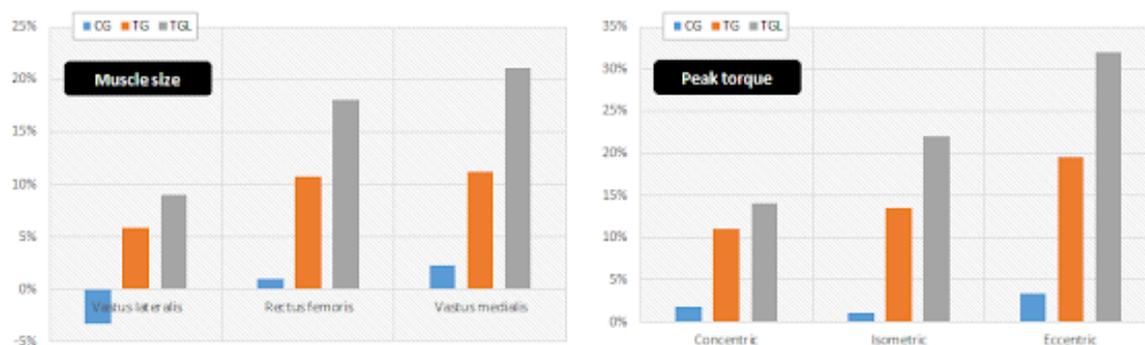
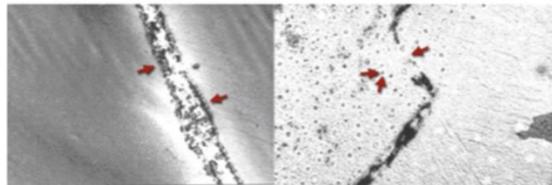


Figure 2: Muscle size and peak torque changes over the course of the 8-week study (Baroni, 2014).

As you can see, red and near-infrared light also have the ability to increase your strength and endurance adaptations to exercise, decrease muscle damage from your workouts, help you recover faster, and even increase muscle gains.

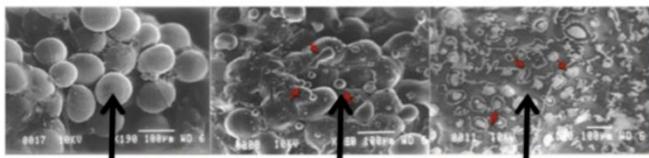
Increase Fat Loss (And Burn Off Stubborn Fat) with Near-Infrared and Red Light Therapy

How does red light therapy enhance weight loss, fat burning, and shrink waist circumference? While there is still some debate among researchers over the exact mechanisms involved, the research clearly shows that it does work.³⁵² The most popular theory among researchers is by causing fat cells to release stored fat into the blood stream, where it can then be burned off during energy expenditure or via exercise.



Adipose Cell Membrane

Pore Formation on the Cell Membrane



Adipocytes

Fat Droplets

Shrinkage of Adipocytes

Research has shown that near-infrared and red light therapy has a profound impact on reducing fat mass and fat tissue, and at eliminating cellulite.

In studies, near-infrared and red light therapy have **helped shave an entire 3.5 to 5.17 inches off waist and hip circumference by reducing the fat mass layer in just four weeks of use.**^{353,354}

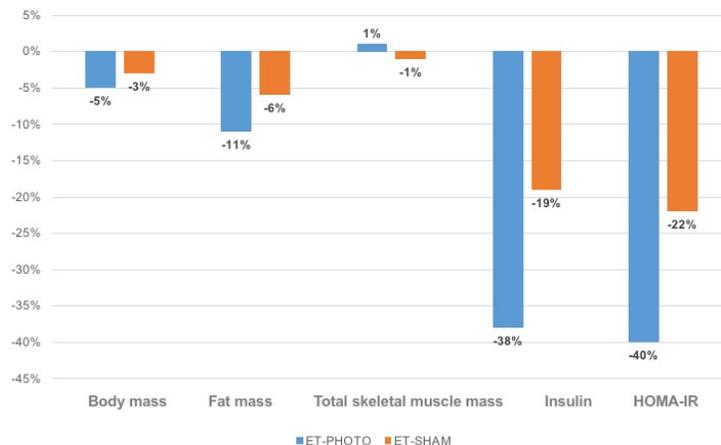
Near-infrared and red light therapy works to not only release the fat into the blood, but does so *without* negatively affecting blood serum lipid profiles.³⁵⁵

In another study of 86 individuals using red light therapy at 635 nm for **20 minutes every other day for two weeks, study participants lost 2.99 inches across all body parts – yes, 3 inches – in just 14 days** of red light therapy.³⁵⁶

That said, I am not a strong advocate of trying to use red/NIR light therapy *alone* to cause fat loss. Where I believe red/NIR light therapy really shine (forgive the pun) is when combined with exercise.

Some research shows that near-infrared light therapy can dramatically enhance – nearly double – fat loss from exercise, as compared to people doing just the exercise routine without the NIR light therapy.³⁵⁷

In addition, **the group using the NIR light therapy in tandem with exercise saw nearly double the improvements in insulin resistance!**³⁵⁸



The above graph shows the differences in reductions in body weight, body fat, insulin levels, and insulin resistance (IR) from either NIR light therapy (ET-PHOTO) vs. sham/placebo light therapy (ET-SHAM). As you can see, exercising with NIR light **nearly doubled the loss of body fat** and nearly doubled the improvement in insulin resistance.

There is also some fascinating potential for use on “stubborn fat” areas and even the mythical “spot reduction.”

For those not familiar with these terms “stubborn fat” and “spot reduction,” I’ll summarize below...

What is stubborn fat? And what is spot reduction?

- Stubborn fat = Areas where we store body fat that’s hard to get rid of, no matter what we do. Stubborn fat areas are the last places we store body fat.
- Spot reduction = The idea that you can burn off fat in a specific area by doing exercise that targets that area.

So really everyone knows what spot reduction is. How could we not know about the idea of stubborn fat and spot reduction?

For the last several decades, infomercials on TV have been selling us various exercise gadgets that are meant to cause fat loss in the specific area. “Use this ab cruncher and you’ll shed inches of fat off your waist and stomach!” “This thigh blaster will take inches off your thighs!”

It is absurd how many billions of dollars have been spent by consumers in the pursuit of spot reduction--mostly through various exercise devices (like thigh masters, ab crunchers and butt blasters), wraps that cause temporary water loss, and electrical stimulation devices that shock muscles in a targeted area.

Walk into any gym around the world and you’re likely to find lots of men trying to burn off unwanted abdominal fat with 30-minute long ab workouts, and women doing all sorts inner and outer thigh exercises and “butt-toning” aerobic classes. Most of us have some area of our body that has a little excess flab, and most people think the solution to this problem is to do exercises for that area.

We all tend to store fat in certain areas--men more in the belly/lower back/love handles, and women more in the thighs and hips (generally speaking) – so given that our body deposits fat in specific areas, it seems to make sense to also pursue fat loss from those specific areas.

Indeed, we’ve been pursuing the goal of spot reduction for well over a century. There were the vibrating belt machines of the early 1900s, countless other machines that looked like they could double as torture devices, and of course, corsets, which have been around forever (and seem to be making a comeback). These devices that we’ve seen come out over the last few decades are really nothing new. They’re just the latest gadgets to be created in the century-long pursuit of spot reduction.

So what is the bottom line on spot reduction? Do any of these devices really work?

The simple answer: No. Most of these are based on general public’s lack of understanding that muscle and fat are two separate and distinct tissues, and they confuse the “burning” one feels when working a muscle with the “burning” of body fat from the layer of fat on top of that muscle. Unfortunately, these are two distinct entities, and working a muscle in a specific area does not have a significant relationship to how much fat is burned off from the adjacent layer of fat. Yet, since most people don’t understand that, they are gullible for products selling them on the idea that working a muscle in a specific area will cause fat loss in that area. Or to use the words of the people who manufacture these spot reduction products, these devices will “tone,” “shape,” “trim,” and “sculpt” that area of your body.

Interestingly, there have been some studies testing whether spot reduction really exists:

- A 1971 study conducted on tennis players also found evidence to confirm this. Tennis players constitute a population whose right and left arms have been consistently subjected to very

different amounts of exercise over several years. Consequently, if spot reduction were a valid concept, one would expect the players' dominant arms to have thinner layers of subcutaneous fat compared to their non-dominant arms. When the researchers measured the thickness of subcutaneous fat at specific points along the players' arms, however, they found no statistically significant difference between right and left arms.³⁵⁹

- A classic study that was performed back in 1984, looked at fat biopsies taken from the abdominal area before and after a 27-day period that had subjects progressively increase the number of sit-ups they were doing. Subjects started with 140 sit-ups a day and by the end of the study they were doing 336 sit-ups a day. The group averaged 185 sit-ups a day while a control group did not exercise. Following the study, the fat cells in the abdominal area were not reduced. There were no significant changes in either fat-folds, girth, or total fat content assessed by underwater weighing. **Over 5000 sit-ups and zero fat loss off the stomach to show for it. That's pretty damning evidence to show that spot reduction is not possible.**³⁶⁰
- More recently, in a 2007 study led by the University of Connecticut, 104 participants completed a twelve-week supervised resistance-training program in which their non-dominant arm was selectively exercised. MRI assessments of subcutaneous fat before and after the program revealed that fat loss was generalized across the entire body, rather than only occurring in the exercised arm.³⁶¹
- Even more recently in 2013, another even more impressive study was published. Three times per week, for 12 weeks, the participants were required to do about 1,000 repetitions of low resistance activity on a leg press machine. Here's the cool part: They only did the exercise on *one* leg and left the other one unexercised. What was the result? **The participants lose 5.1% of their body fat on average, but virtually none of that loss came from fat tissue in the legs – there were no differences in fat mass on the legs at the end of the 12 weeks of training compared to when they started. Most importantly, there was no difference between the leg that did all that exercise and the leg that wasn't exercised at all!** Where did the fat loss come from? It came from the upper extremities and torso. In short, if you can do 1,000 repetitions of an exercise on one leg, three times per week, for 12 weeks, and that doesn't lead to any detectable difference in fat on that leg relative to the leg that wasn't exercised at all, then that's pretty clear evidence that chasing spot reduction through "ab crunchers" and "thigh blasters" is a big waste of time and money.

So the science is clear: Exercising a muscle does not cause fat loss in the adjacent fat tissue. You don't lose fat off your stomach by doing crunches, or lose fat off your thighs by using the thigh machines at the gym. And for several decades, this is exactly what all respectable fitness professionals have been preaching: Spot reduction is a myth!

Simply put, the scientific consensus about spot reduction through muscle contractions is that it does not work.

There are a couple of reasons why this is the case:

- 1) There's no direct link between the underlying muscle and the overlying fat. So in order for working a muscle to cause fat next to it to be burned off, that fat would have to be connected to the muscle via blood vessels. Yet, there is no such direct connection between muscles and their adjacent fat area. This means that working a muscle in a particular area, basically has no effect on the rate of fat burning in the fatty tissue adjacent to it. Performing those exercises may strengthen the muscle responsible for those movements, but they have negligible impact on reducing the amount of fat stored there.

- 2) Fat contained in fat cells exists in the form of triglycerides, and muscle cells cannot directly use triglycerides for energy. The fat must be broken down in glycerol and free fatty acids first, then enter the bloodstream where they can be carried to the muscle cells for burning. So there really is no reason for the muscle to preferentially use fats from the fat cells adjacent to it – it is using up the fatty acids in the bloodstream and doesn't care whether those fatty acids were released from the fatty area right next to it or from the other side of the body.

The bottom line: Spot reduction via exercising a specific body area doesn't work. Working a particular muscle does not impact the amount of fat in the fatty area adjacent to the muscle being worked. Whether you lose fat or not comes down to overall energy balance. But you have no control over *where* your body takes that fat from. Your body will lose fat from some areas quicker than others, and there is nothing you can do about it. This has pretty much been the consensus among highly-educated health professionals for the last several decades and is what I personally taught for a decade.

But it may actually not be correct...

It's generally true that just working a particular muscle doesn't burn off the fat in the fat tissue adjacent to that muscle (i.e. thigh exercises don't selectively burn off thigh fat), but with an understanding of *why* stubborn fat is actually stubborn, perhaps we can impact things after all.

Even though most fat loss experts shun the idea of targeting fat loss in specific areas of the body, there are actually a few experts who have suggested that it is possible through a slightly different approach that revolves more around burning lots of calories (not just exercising the muscle in a specific area, like the abs or thighs) combined with selectively enhancing blood flow to certain fatty areas of the body.

For example, Dr. Lonnie Lowery (a bodybuilder) and Christian Thibaudeau (a strength coach) have both developed spot reduction protocols published on a website called T-Nation. And exercise physiologist Lyle McDonald has written a book called *The Stubborn Fat Solution*. That book presented a ton of new science-backed information that shows the physiological reasons why some fatty areas are harder to burn off than others--the areas that don't seem to come off no matter how much dieting and exercise you do, thus, "stubborn fat." Some areas of the body store fat easily and release it poorly. Other areas don't get fat very easily and those areas are the quickest to lean out. That is, in the context of someone doing things right with their lifestyle such that they are losing body fat, the body burns off body fat from some areas more so than other areas. So what is going on physiologically to make this the case – why are some areas so easy to put on fat and so difficult to get lean?

Those reasons are outlined by McDonald in the book, but here's a summary:

1. **Poor blood flow to certain fat tissues.** Certain fatty areas of the body (mainly the stomach and low back areas of men, and the thighs and hips on women) receive poorer blood flow than visceral fat (fat in the center of the body around the organs). If there is little blood flow to those fat cells, they are not able to dump their fats into the blood to be burned for energy. How can you possibly lose fat if your body's fat cells aren't able to dump their fatty acid contents into the blood where they have the potential to be burned? They can't. When there is low blood circulation to the fat cells, the potential for fat to be burned from those cells is also low. Even when you're in a state where you're burning lots of body fat (i.e. on a weight loss diet), very little of the fat you're burning will be coming from these areas that have poor blood circulation.
2. **Muscle cells become de-sensitized to insulin and fat stores become hyper-insulin sensitive.** This is the body's way of shuttling the calories you eat away from muscle cells (where they are burned off) and towards fat cells (where they are stored as fat). The above-

mentioned gender-specific fatty areas also tend to be more insulin sensitive and generally speaking, soak up nutrients from the blood most efficiently.

3. **Fat cells themselves become resistant to releasing fat due to their receptors.** There are two types of adrenoceptors (receptors that respond to adrenaline) that control the flow of fatty acids in and out of fat cells and the blood flow to the fat cells--beta and alpha receptors. Beta receptors are the good guys who increase fat burning and fat tissue blood flow. Alpha-2-receptors do just the opposite – they inhibit fat burning and they inhibit fat tissue blood flow. Stubborn fat areas have a high density of alpha-2 receptors and low density of beta receptors. So not only is there poor blood flow to these fatty areas (making it difficult for the cells to release any fats into the blood to be burned), but also, the fat cells themselves are incredibly resistant to releasing any fats into the little blood flow that is present.

McDonald's program to burn off this stubborn body fat is essentially that you do a morning protocol before breakfast whereby you do some things to boost adrenaline levels (high-intensity interval training, and taking tyrosine), take some yohimbine to inhibit the alpha receptors on your fat cells, and then do some light exercise. The idea is that this would boost adrenaline and then also allow stubborn fat cells to release more of their fats into the bloodstream, and then you would burn off some of these stubborn fat areas. Many people have reported success using this method, so it does appear to work. (Side note: I once tried it and the yohimbine made me feel so anxious and jittery that I never wanted to do it again. It was like 8 cups of coffee and what I can only imagine crack must feel like.)

Now, it's important to realize, as McDonald himself points out, that this is *not* true spot reduction. This is simply for people who are already doing a calorie restricted diet and *actively losing fat*, but still have one area with some fat that won't come off. It is not spot reducing that specific area – you are burning overall fat, but the only place left to burn it from is that specific area. While oversimplifying the nuances, basically, the idea of this protocol is just to get more blood circulation to those stubborn fat areas and pair that with exercise (burning off fat) with the hope that a large portion of the energy you burn would come from fat in the stubborn fat areas. With greater blood circulation in those stubborn fat areas, your body will have the opportunity to release and burn more of the fatty acids stored in those tissues.

Even though this is not really spot reduction per se, McDonald's examination of all the scientific literature on why certain fat tissues are so hard to burn off was instrumental as a step towards figuring out how to get rid of stubborn fat. The most important factors in this regard are how the cellular receptor profile influences how easily the cell will give up its fats into the bloodstream, and even more importantly, the blood flow to that fatty area. Poor blood flow to an area combined with cells that are resistant to giving up their fats makes fat loss from that area essentially impossible.

Science has now shown that blood flow to a particular area might be the biggest factor of all that hinders fat loss from that area. Blood flow is critical for fat extraction. Poor blood flow equals poor fat loss. Here's a fun test that you can do to put this in practical terms. Buy a forehead thermometer and take the skin temperature of different parts of your body. In particular, test the temperature of your hard to burn off fatty areas. What do you notice? They are a *lot* colder than other areas of your body. I myself have tested this extensively and found that generally, the lower abs/love handles/lower back areas (typical areas where men tend to store stubborn fat) have temperatures that are 1-2 *full degrees* Fahrenheit lower than other areas of my body. Just prior to writing this, I told my wife about it and she didn't believe me. So she immediately grabbed our thermometer to test it. Sure enough, if she measures in most places on her body, she gets between 97-99 degrees F, but on her butt and thighs, it is between 94.7-95.7 F. Again, that's 2-3 full degrees F lower than anywhere else on her body. This is not a coincidence. Areas that are hard to burn fat are primarily that way due to lack of blood flow to that region, therefore they are significantly colder. Blood flow to the tissues is a huge factor.

As physiology expert Dr. Keith Frayne notes in Proceedings of the Nutrition Society: "There is evidence that adipose tissue blood flow does not increase sufficiently to allow delivery of all the fatty acids released into the systemic circulation."³⁶² In other words, fatty acids may indeed be getting released from the cells in our hard to burn off fatty areas, but due to poor circulation to those areas, most of those released fats don't even make it into the bloodstream where they have the potential to be burned. So they end up just getting deposited right back into the fat cells they originated from, essentially being locked off in that area.

If we can somehow cause a specific fatty area on our body to have all its blood vessels dilated and be filled up with blood, and if we can preferentially stimulate the fat cells in that specific area to release their glycerol and free fatty acids into the bloodstream, then we have the key to targeting fat loss to specific fat areas on our body.

Now here's the key thing to understand: Most people who have tried to lose fat in a "stubborn fat" area have been trying to pursue the goal of either enhancing localized fat burning or increased blood flow to a particular region through muscle contractions in the muscle next to the fat we want to burn off. As research (that I showed you above) has already proven, relying on muscle contractions in a specific area to burn fat from the layer of fat next to that muscle is basically a worthless approach.

But what if there were a truly effective way to get the fat cells in a particular area to be perfused with blood and release their fats into the blood? Something that no one talking about spot reduction has yet thought of.

It turns out that red/near-infrared light affects both blood circulation to the area it's shined on, as well as stimulating the release of fatty acids from fat tissue!

And there are numerous studies showing it contributes to fat loss:

Here's a quote from one review of the scientific literature on the ability of red/NIR light to help with fat loss:

"Within the past decade, LLLT has also emerged as a new modality for noninvasive body contouring. Research has shown that LLLT is effective in reducing overall body circumference measurements of specifically treated regions, including the hips, waist, thighs, and upper arms, with recent studies demonstrating the long-term effectiveness of results. The treatment is painless, and there appears to be no adverse events associated with LLLT. The mechanism of action of LLLT in body contouring is believed to stem from photoactivation of cytochrome c oxidase within hypertrophic adipocytes, which, in turn, affects intracellular secondary cascades, resulting in the formation of transitory pores within the adipocytes' membrane. The secondary cascades involved may include, but are not limited to, activation of cytosolic lipase and nitric oxide. Newly formed pores release intracellular lipids, which are further metabolized."³⁶³

To give you an idea of some of the research:

- A group of 20 women riding stationary bicycles 3 times per week for 4 weeks while being exposed to NIR lost (on their waist, hips, and thighs) an average of 8 centimeters or 444% more fat (specifically on the waist, hips, and thighs) as compared to 20 women doing the same exercise without NIR.³⁶⁴
- Studies on "laser liposuction" have also shown that red/NIR light therapy alone can even have significant fat loss benefits. "LLLT achieved safe and significant girth loss sustained with cumulative

treatments of 8 treatments over a 4 week period. The girth loss from the waist gave clinically and statistically significant cosmetic improvement." ^{365,366}

Given that red/NIR light stimulates both blood circulation and the release of fatty acids from fat cells, it is reasonable to believe that it may very well be the most effective tool out there for getting rid of stubborn fat. While more research is needed to confirm this, I actually developed a "stubborn fat protocol" around this several years ago, and based on my experimentation over the last few years with clients, I can say with a high degree of confidence that it works amazingly well.

Here's how to do my Stubborn Fat Protocol:

- 1. Start when you wake up in the morning in a fasted state.**
- 2. Get your body (and especially the stubborn fat area) warm.** A hot shower or sauna is great. Then put on clothes to stay warm, and maybe even use extra clothing on the stubborn fat areas.
- 3. Do some light warm up exercise (walking, resistance bands, yoga, calisthenics, etc.).**
- 4. Remove clothing from the stubborn fat area and do 3-7 minutes of red/NIR light exposure on the stubborn fat area at 6" away from the light.**
- 5. Do 5-10 minutes of high-intensity interval training (HIIT).** There are many variations of how to do this. But to keep it simple, do fast-paced bodyweight exercises like squats, pushups, burpees, jumps, jumping rope, running, or cycling. There various time intervals for workout and rest periods, but a simple and effective way to get started is to do 20-45 second bursts of high-intensity effort with 10-30 seconds of rest between each interval.
- 6. Go for a long walk for 30-60 minutes.** (During this period, keep your body warm, especially the stubborn fat area to keep optimal blood circulation in that area. You can even add a neoprene wrap to the area to create extra heat and blood circulation.)
- 7. Ideally, wait at least 1 hour before eating.**

Do this protocol in the mornings during a fat loss phase (i.e. a period when you are actively on a weight loss regimen and losing fat) and you'll notice that you are slimming down in those stubborn fat areas more than you ever have before!

Now, this isn't the only potential way that you can use red/NIR light therapy to support fat loss. Some studies have shown that using the light in tandem with exercise (before or after) on the muscles used during the workout (as opposed to on fat areas) leads to increased overall fat loss.

Again, please note that red/NIR light therapy doesn't actually burn off the fat by itself. The mechanism appears to be that it causes the fat cells to release their stored fat into the bloodstream where it can (potentially) be burned for energy. One still must be in a calorie deficit to have actual fat loss. Your overall diet and lifestyle must be conducive to overall net fat loss, otherwise you will just put back the fat right back into the fat cells it was released from. If you're not actively doing nutrition and lifestyle interventions to lose fat, please don't think that the light therapy alone will cause fat loss. Think of it more as a tool to *amplify* the fat loss effects from diet and exercise, rather than a tool that generates fat loss by itself. Nevertheless, this technology can be used to greatly accelerate loss of overall body fat, and even "stubborn fat" from fat areas that normally are resistant to being burned off – for men, this is the lower abdomen and love handles, and for women, the hips and thighs most typically, or belly fat.

Overall, the research is clear that red/NIR light can be a powerful tool to support your fat loss efforts.

So, with a red/NIR light therapy device of your own, you can potentially achieve significant weight loss and fat reduction (and dramatic improvements in insulin sensitivity) in the comfort of your own home.

Summarizing the Benefits of Red and Near-Infrared Light Therapy

In summary, near-infrared and red light therapy are incredibly powerful tools you can use to dramatically enhance your health. As I said at the beginning of this book, if there were a drug that had scientific research showing all these benefits, it would be an absolute blockbuster drug for pharmaceutical companies – it would be hailed as a “miracle drug” and prescribed to basically *everyone*.

Here’s the best part: That “drug” exists. It’s just not in the form of a pill. It’s in the form of near-infrared and red light therapy!

From Adel Moussa, the author of SuppVersity, a popular fitness blog that reviews scientific research:

“When I started this blog a few years ago, I was guilty of believing that supplements would be the most relevant ergogenics [performance enhancers] for anyone who trains, myself. Today, 2,300 articles later, this has changed: don't get me wrong - supplements can be useful, but diet, training and - at least in a few cases - even things like using light emitting diode therapy (LEDT) or low-level laser therapy (LLLT), as it is also called, are much higher on the ‘things that really work’-list.”³⁶⁷

This is a remarkable quote. Basically, after reviewing thousands of studies examining supplements, he concludes that, in general, red/NIR light generally provides bigger effects than the vast majority of supplements. This is also notable because there is so much focus and attention on supplements, and so few people have heard of red/NIR light therapy.

Now that you can see how red and near-infrared light have the potential to help combat skin aging, improve brain health, decrease pain and speed healing, improve mental and physical performance, increase muscle growth and/or fat loss, and many other benefits, you’re probably wondering how you can get your hands on one of these devices.

You might also be thinking: “There are lots of red LED lights for sale on Amazon and eBay that claim to have health benefits...so how do I know which devices work best and which device I should get?”

There are indeed hundreds of different red light devices for sale online – devices for the face, hair, tendons, and more.

Here’s the crucial piece of information you need to know: **Virtually ALL of these devices – even the ones that cost hundreds of dollars – are grossly underpowered, too small, and ultimately, ineffective or very time-consuming to use, or both.**

To understand why, let’s talk about red light therapy dosing...

Don’t worry, there are several companies that offer high quality devices and products, and I am going to break down my recommendations for you in later section.

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