

What's the Science Behind Red Light Therapy?

By Zia Sherrell · Gauri Madan, MD
Updated on April 08, 2024 ·

Fact checked by Rimgaile Biekaitienė, MSc

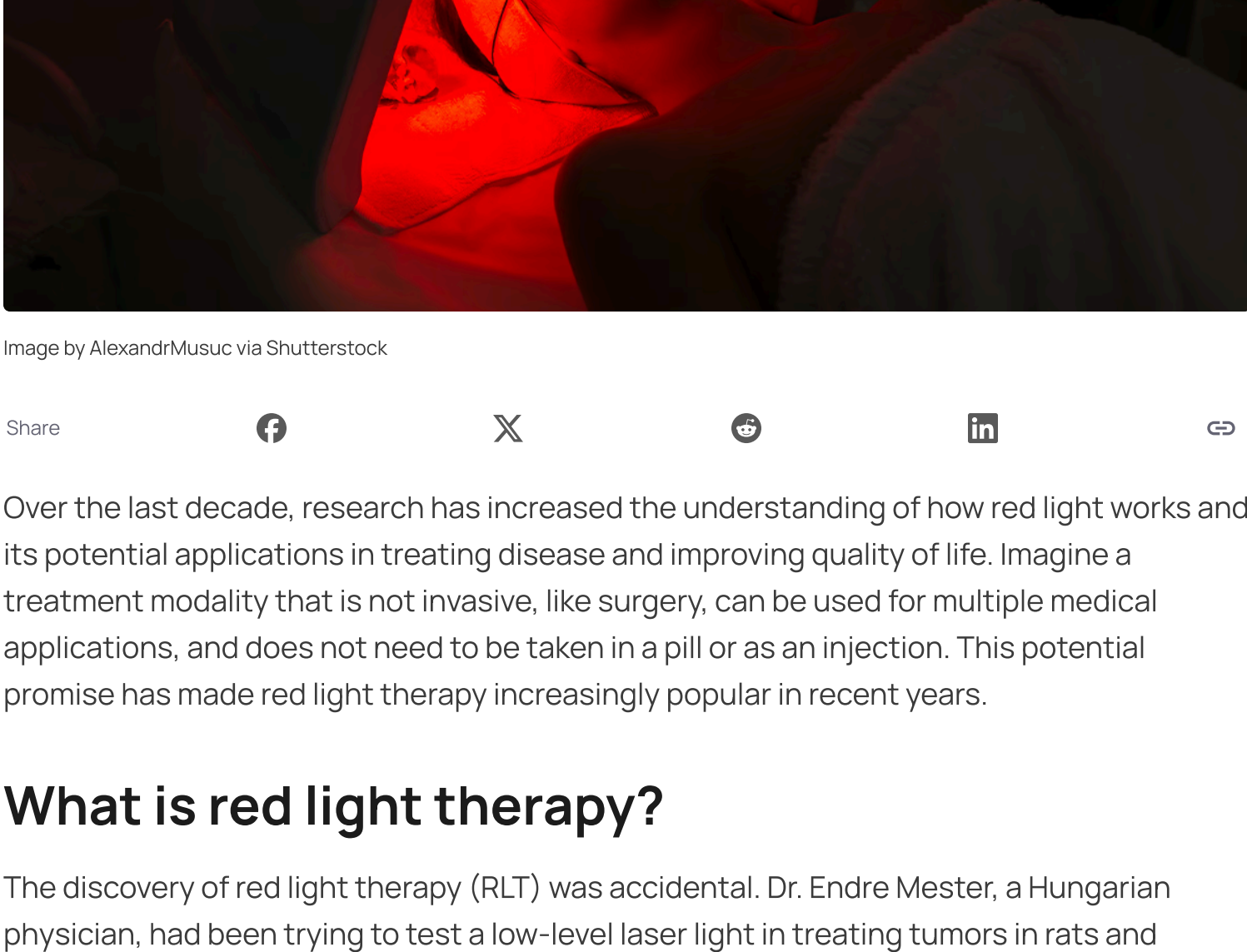


Image by AlexandrMusic via Shutterstock

Share

Over the last decade, research has increased the understanding of how red light works and its potential applications in treating disease and improving quality of life. Imagine a treatment modality that is not invasive, like surgery, can be used for multiple medical applications, and does not need to be taken in a pill or as an injection. This potential promise has made red light therapy increasingly popular in recent years.

What is red light therapy?

The discovery of red light therapy (RLT) was accidental. Dr. Endre Mester, a Hungarian physician, had been trying to test a low-level laser light in treating tumors in rats and [observed improved wound healing and hair growth](#) in the region where he had used the laser.

Red light therapy, historically referred to as low-level laser therapy or low-level light therapy (LLLT), is a type of photobiomodulation (PBM) therapy. Photobiomodulation is the concept of using [light energy to change how a cell functions](#).

Light particles (photons) travel in waves and are described based on the wavelength, frequency of the waves, and the energy they carry. As the frequency decreases, the length of the waves increases, and the energy decreases. Red light has the lowest energy level and longest wavelength within visible light on the [electromagnetic spectrum](#). Lower on the spectrum is infrared radiation, which is not visible to the human eye. The infrared spectrum can be divided into near, middle, and far infrared light. Studies have shown that [skin penetration by light](#) increases with an increase in wavelength. Due to this, red light therapy often includes a mix of red light (620–750 nm) and near-infrared light (760–1400 nm) wavelengths.

While red light therapy started as a laser, the development and subsequent use of light-emitting diodes (LEDs) has made it more affordable and accessible.

How does red light therapy work?

While more research is needed to understand precisely how red light therapy works for specific conditions, lab studies on the effect of red light on cells have demonstrated some mechanisms on how it may improve cell and tissue function.

- 1. Stimulation of mitochondrial function.** The mitochondria are the energy production center of our cells. It uses the enzyme cytochrome c oxidase (CCO) to make adenosine triphosphate (ATP) – an energy unit critical to the normal functioning of our cells. [CCO has been found to be sensitive to light](#) and responds with a structural change that allows it to remain switched 'on,' making more ATP and other necessary signaling molecules, increasing the efficiency of the rest of the cell.
- 2. Increasing natural antioxidants.** Along with the increase in ATP, oxidative stress in the form of reactive oxygen species (ROS) is also produced. While lots of oxidative stress can lead to cell damage and death, using red light to create [low levels may be beneficial](#) by pushing the body to produce natural antioxidants and an anti-inflammatory response.
- 3. Activation of light-sensitive ion channels.** [Light-sensitive ion channels respond to changes in light](#) to allow the flow of ions across the membranes that border the cells. These ions, especially calcium, are involved in activating signals within the cell to increase or decrease cell activity.

What is red light therapy used for?

Red light therapy has a demonstrated benefit for several medical and cosmetic uses we will discuss below.

Red light therapy for skin issues

The effect of red light therapy has been studied for several skin concerns as penetration at different wavelengths is possible. In addition to improving cellular function, red light therapy is thought to [improve skin health by influencing cell growth and development](#).

Acne

Red light has been [studied for acne treatment](#) based on its anti-inflammatory and antibacterial effects. As it is able to penetrate further into the skin, it likely also disrupts the production of sebum in the gland.

While there is some anecdotal evidence for the overall improvement of scars and reduction of active acne, treatment with blue light, a combination of blue-red light, and infrared laser has been found to be more effective.

Wound healing

While wound healing with low-level light/red light has been a topic of research for several decades in animals and humans, the clinical trials performed have small sample sizes and vary widely in terms of wavelengths and dosage. [NASA performed several in vitro, animal, and human studies](#) using red-light therapy in the 1990s, which showed some success in enhancing wound healing, especially when used in conjunction with hyperbaric oxygen therapy.

A review published in 2021 analyzing 50 studies on the [effect of red light therapy on diabetic wounds](#) also demonstrated optimistic findings about the potential for using RLT in wound healing but emphasized the need for further research.

Wrinkle reduction

As we age, the skin becomes thinner, the production of the underlying collagen slows down, and the fat in the subcutaneous layer decreases, leading to fine lines and wrinkles. Unlike laser therapies like intense pulsed light (IPL) and laser resurfacing, [red light therapy does not cause damage to the tissue](#).

As RLT needs to target different layers of the skin to improve wrinkle appearance, most studies used multiple wavelengths in the red light and near-infrared spectrums. While [clinical trials show improved wrinkle appearance](#) with increased collagen density, the studies are small, and more research is needed.

Reducing stretch marks

[Stretch marks](#) are caused by changes in the structure of the connective tissue supporting the skin when there are rapid changes in body size. The body is unable to compensate quickly enough for the change, and a scar-like tissue forms. As red light therapy has been shown to increase collagen density, it is likely that [RLT could potentially improve the appearance of stretch marks](#). However, there is currently no research on the treatment of stretch marks with RLT.

Pain relief through red light therapy

The mechanism through which red light therapy provides pain relief is not completely understood but is thought to be through [promoting tissue regeneration, decreasing inflammation, and preventing cell death](#). Using near-infrared light in an [area of localized pain](#) is also thought to target the nerve cells attached to the pain receptors and inhibit signals from being transmitted to the brain, thereby improving pain control.

The research on [pain and disability in knee osteoarthritis](#) has demonstrated significant improvement with treatment using low-level laser therapy compared to placebo. Given that the knee is the joint most often affected by osteoarthritis, having a nonpharmacological and nonsurgical treatment option can make a difference in the quality of life for a significant portion of the population. It is not surprising that there are many commercial [at-home devices for the treatment of knee pain](#).

Improving sleep quality with red light therapy

Unlike blue light, red light is not associated with the suppression of melatonin levels or any changes in the circadian rhythm. In fact, using a red light mask while asleep has been shown to [improve sleep inertia](#). A recent phase II clinical trial for a collar that emitted a combination of four wavelengths in the red light/near-infrared light spectrum suggests that exposure of the head and neck region to red light before sleep can also [help improve self-reported sleep and relaxation](#) while improving performance during the day.

Red light therapy for enhancing energy

Many users have praised red light therapy for making them feel energized. While there is **no clinical evidence that RLT boosts energy**, there may be a few reasons for this experience of improved energy levels. Through its mechanism of action within the mitochondria, we know that RLT stimulates the anti-inflammatory pathway and increases ATP production.

In addition, a study showed that RLT may [improve cognitive function](#) by influencing attention, memory, and executive function in young, healthy subjects. However, the authors acknowledge the need for further research before firm conclusions can be drawn.

There is also some evidence that [red light therapy can decrease muscle fatigue](#). The increased efficiency in energy use and subjective improvement of how the body feels through increased ATP production, reduction in inflammation, reduced cognitive load, and improved muscle recovery are likely to enhance overall energy.

Red light therapy for brain health

Trials using red light therapy for brain health often use transcranial devices and wavelengths in the near-infrared spectrum to increase the likelihood that the light can penetrate through the bone of the skull to reach the brain tissue. As mitochondrial dysfunction is implicated in dementia and neurodegenerative disorders like Parkinson's and Alzheimer's disease, there is a lot of interest in the use of RLT for treatment.

[Animal studies and small clinical trials for Alzheimer's disease](#) show a decrease in the characteristic abnormal tau protein and neurofibrillary tangles, increased blood flow to the brain, and a decrease in inflammation and cell death. While animal and human studies on neurodegenerative diseases note [improvements in cognition and symptoms](#), the trials are small, and more research is needed.

Are there contraindications to red light therapy?

Red light therapy is a safe treatment modality for most people. Since the clinical research on RLT is fairly recent and there is conflicting data, the risk of treatment has not been determined. However, some [recommendations have been made for contraindications](#) to RLT.

- **Malignancies.** As RLT improves the function and growth of cells, it is possible that it may do the same for cancer cells.
- **Pregnancy.** There is not enough evidence to show that red light therapy use on the abdomen would not affect the fetus. Localized red light therapy used on other parts of the body, such as handheld devices and masks, may be used safely during pregnancy.
- **Thyroid disease.** RLT around the neck and upper chest has been shown to increase thyroid activity and is contraindicated in those with hyperthyroidism. Patients with hypothyroidism should speak with their doctor before using RLT.
- **Recent burns.** Tissues damaged by burns are sensitive to further damage by heat, and RLT should be avoided in the affected region for a few days.
- **Epilepsy.** The evidence for avoidance of RLT in patients with epilepsy is conflicting as it depends on a variety of individual factors. As there is no standardization for devices, flicker from the LED bulbs may lead to a seizure. Talk to your neurologist before using RLT if you have been diagnosed with epilepsy.
- **Infections.** Red light therapy may increase the growth of some bacteria, and avoidance of RLT in the region of active infections is recommended unless cleared by your doctor.
- **Photosensitivity.** Some diseases, such as Lupus, and some medications increase the skin's sensitivity to light, and the use of RLT may cause damage to the skin.

Please speak to your doctor if you have any concerns about starting red light therapy.

Where can one get red light therapy?

Red light therapy is becoming more popular in professional settings, and you may notice it being offered as an adjunct treatment in:

- Gyms for muscle recovery
- Dermatology clinics for skin health and aging
- Spas for skin rejuvenation and relaxation
- Physical therapy, chiropractic, and orthopedic offices for pain

The benefit of in-office services is that it is usually combined with other treatments, and the devices used are professional grade and generally more expensive.

However, [in-home red light therapy devices](#) are also widely available. Red light therapy requires consistency to see real benefits, and having a device at home can be much more convenient. [In-home red light panels](#) can be used for full body treatment and usually only provide red and near-infrared light. For more [targeted therapy](#), hand-held devices, masks, caps, and wraps are also available.

Side effects of red light therapy

Red light therapy has been found to be safe for most. However, prolonged and improper use of red light therapy has caused adverse reactions in some people, such as exacerbation of migraines and burns.

While there is ongoing research on RLT for certain eye diseases, there is a risk of permanent damage to retinal tissue with bright light and prolonged exposure to red light. [Protective goggles should be worn while using RLT](#).

Red light therapy shows exciting promise as a multifaceted and non-invasive treatment option for skin health, pain relief, boosting energy, improving sleep, and supporting brain health. While further research is needed to fully elucidate its mechanisms, it is also necessary to create greater standardization when testing to optimize the potential indications for use. This, along with more clinical research, will help improve the available evidence and increase accessibility for more people.

FAQ

Who should not use red light therapy?

Red light therapy is safe for most people to use. But if you have cancer, epilepsy, or any condition that increases light sensitivity, you should not use red light therapy. Direct red light use over the abdomen during pregnancy and any region affected by a burn or active infection should also be avoided.

Can you overdo red light therapy?

Prolonged use of red light therapy can cause skin damage. It may only cause some increased sensitivity, but in severe cases can cause burns. Red light therapy can also trigger migraines in people prone to them with prolonged use. It is recommended that RLT is used only for a few minutes on first use, gradually increasing exposure time. Please refer to the device's instructions for the recommended use time.

What is the best time to do red light therapy?

The best time to do red light therapy depends on you and your use purpose. Some people find that it helps boost their mood and prefer to use it in the morning; others use it to relax in the evening before bed, as red light does not interfere with melatonin production. Red light therapy has been found to be effective before and after exercise for recovery. The most important thing is consistency, so the best time to use RLT is when you can fit it into your schedule.

Can red light therapy cause cancer?

Red light therapy is not strong enough to cause damage to the tissues of most people, and it is very unlikely to cause cancer. However, if someone already has cancer, red light therapy is not recommended.

Key takeaways:

- Red light therapy boosts the health and function of our body's cells, but more research is needed to see significant clinical benefits.
- Red light therapy is safe to use for most people and has minimal side effects.
- Consistency is key when it comes to red light therapy.

10 resources

Article history

Share

Related articles

- 7 Tips To Avoid Biohacking Scams by Dave Asprey
- Ayahuasca Ceremony: Magical Treatment or a Dangerous Overtype?
- A Doctor's Take On Biohacking Nonsense, Some May Be Harmful
- Hot Berry Drink Recipe: A Biohacker's Secret for an Antioxidant Boost
- Luminette Light Therapy Glasses Review 2024: Is It the Key to Better Sleep?
- Coffee Microdosing: A New Approach to Caffeine Consumption

Leave a reply

Your email will not be published. All fields are required.

Comment *

Leave a comment

Name * Enter your name

Email * Enter your email

I am human

Privacy Policy Agreement *

I agree to the [Terms & Conditions](#) and [Privacy Policy](#).

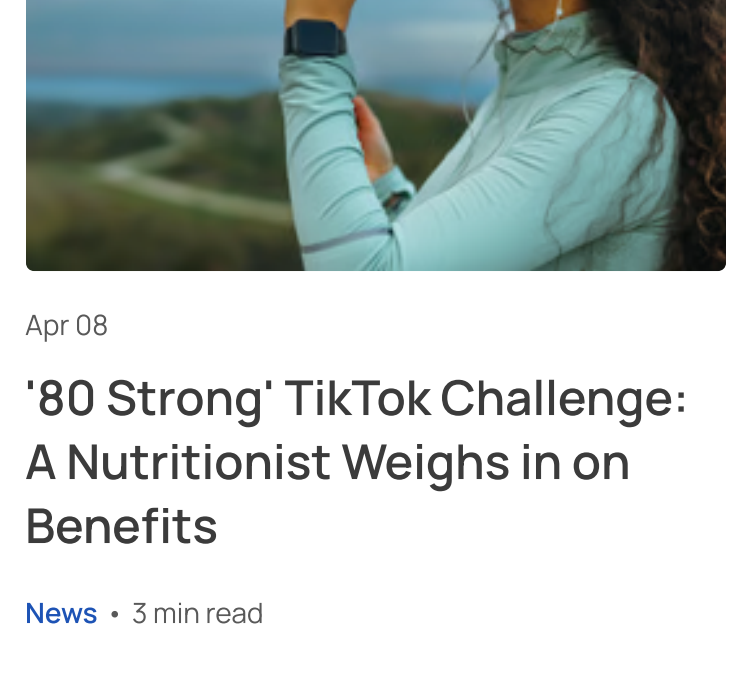
Our content does not constitute a medical consultation in any form and is for informational purposes only. See a certified medical professional for medical advice/ diagnosis.

Women's Health	Men's Health	Family Health	Mental Health	Longevity
Breast health	Prostate health	Reproductive health	Self-care and therapy	Longevity supplements
Vaginal health	Sexual health	Pregnancy	Meditation	Biohacking
Sexual health		Child health	Anxiety and depression	Healthspan
Menopause		Family relations	Eating disorders	
		Dental and oral health		
		Show all →		

Beauty	Nutrition	Fitness	Sleep	Health Conditions
Skin care	Healthy eating	Physical health	Sleep disorders	Diabetes
Hair	Diets	Yoga	Sleep hacks	Endocrine disorders
Non-surgical procedures	Nutrition for conditions	Pilates	Sleep science	Multiple sclerosis
Plastic surgery	Weight management	Running		Cardiovascular diseases
	Vitamins and supplements	Injuries and recovery		Alzheimer's and dementia
				Show all →

Health Insurance	Medicare	Life Insurance	Pet Insurance	Research
Guides	Coverage	Guides	Guides	
	Medicare Advantage		Pet Care	
	Medicare Supplement			
	Guides			

Latest news



Apr 08
'80 Strong' TikTok Challenge: A Nutritionist Weighs in on Benefits

- News · 3 min read
- Costco Offers Members Weight Loss Program Through Sesame Partnership
 - Oral UTI Vaccine Prevents Infections for up to 9 Years
 - Experimental Drug Could Lower Blood Lipids More Than Available Treatments
 - An Unsupportive Partner Raises Your Cortisol Levels

