

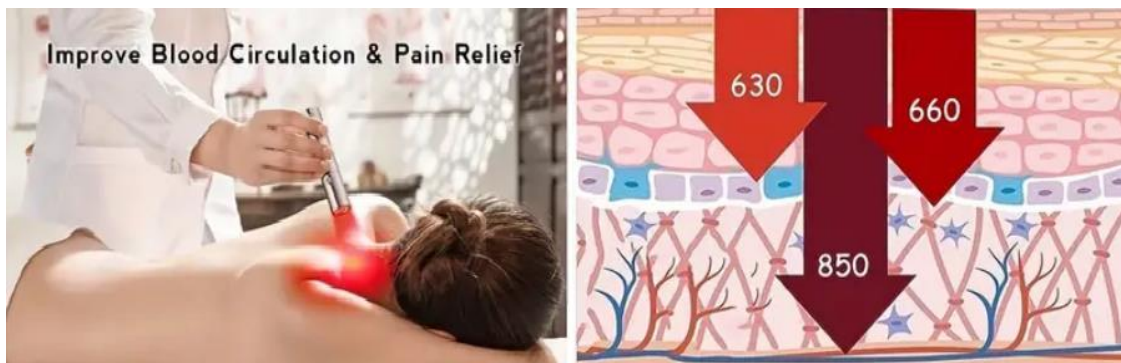
## Infrared (IR) radiation therapy devices

It also called (photo-bio stimulation) are use in physiotherapy to manage chronic pain (joint and muscle pain) in patients.

### Types:

There are **3 types** of infrared: Far, Mid and Near. We are only interested in near infrared ( 750-1000 nm) for the purposes of light therapy, **because** it has the deepest penetration into the body allowing it to affect nerves.

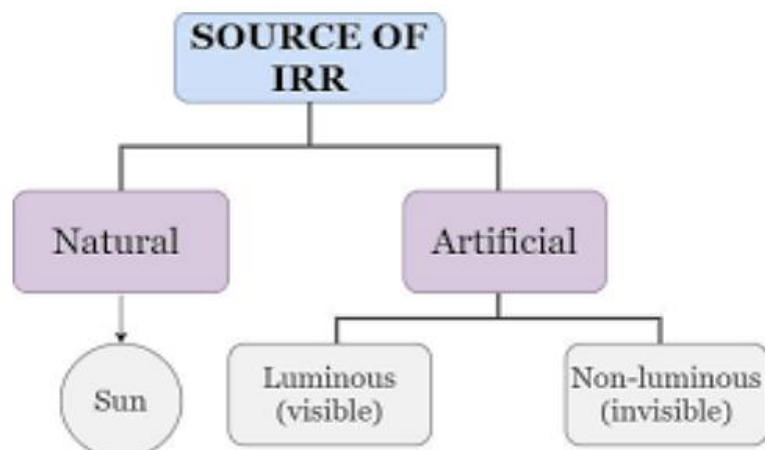
	Wavelength	Photon energy (THz)
Near infrared	0.7–1.4 $\mu\text{m}$ (700–1400 nm)	215–430
Mid infrared	1.4–3.0 $\mu\text{m}$ (1400–3000 nm)	100–215
Far infrared	3.0–100 $\mu\text{m}$ (3000 nm–0.1 mm)	3–100



### Purpose of Infrared Therapy:

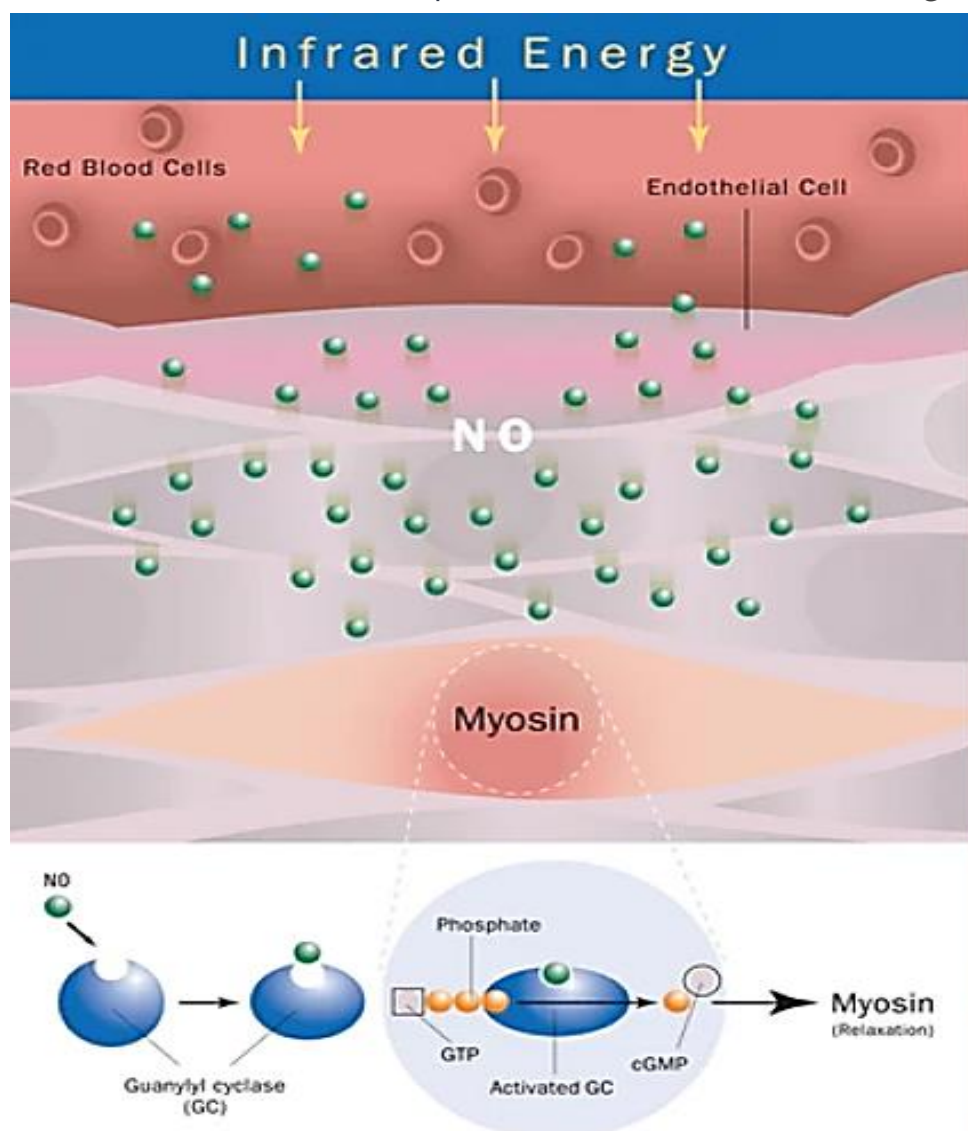
- Decrease in inflammation
- Pain control
- Wound care
- Tissue repair.

### Production:



## How Does Infrared Therapy Work?

- Infrared light has the ability to reach the muscles, nerves and even the bones because it penetrates the inner layers of the skin up to a depth of 2 to 7 cm.
- As Near IR light penetrates many layers of tissue in the body, it encourages nitric oxide (NO) production in the cells. Nitric oxide is a short-lived gas that is crucial to the health of your arteries. NO allows your arteries to relax thereby enhancing blood flow. This allows oxygen and other vital nutrients to be delivered to your tissues and nerves. NO does much more. It also regulates blood pressure, fights free-radicals and prevents platelets from clumping together.
- Increased NO production lasts for several hours after application of the LLLT, which can dramatically increase circulation to injury sites and areas of chronic pain and educes tissue swelling.



## Dosage:

- **Duration** = 10 to 15 minutes
- **During the day** = several times
- Voltage = 250-1000 Watt
- **Wavelength** = 800 nm to 1000 nm



### 9pcs Deep Red 660nm LEDs

- Effectively absorbed by skin, repair skin problem.



### 9pcs Near Infrared 850nm LEDs

- Deeper into skin, more effectively relieving pain.

## Benefits:

- Cells regeneration and their repair.
- Pain relief to reducing inflammation.
- Circulation of oxygen-rich blood in the body, which can help in faster healing of deep tissues.
- improve endorphin levels. مسكن
- has no side effects
- improve cardiovascular health
- IR light is safe. (Ultraviolet light, which has damaging effects on the cells and tissues of the body).

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Low-Level Laser Therapy (LLLT), or photobiomodulation, uses non-thermal, low-power light (1–500 mW) to stimulate tissue healing and reduce inflammation. Dosage is primarily determined by energy density (fluence) measured in  $\text{J}/\text{cm}^2$ , calculated as:

$$\text{Dose (J/cm}^2\text{)} = \frac{\text{Power (W)} \times \text{Time (s)}}{\text{Area (cm}^2\text{)}}$$

⌘

### Key LLLT Dosage and Technical Formulae

- **Energy Density (Fluence):** This is the most crucial parameter, calculating the energy delivered per unit area.

- Formula:  $\text{Energy Density (J/cm}^2\text{)} = \frac{\text{Total Energy (J)}}{\text{Spot Size (cm}^2\text{)}}$ .

- Where:  $\text{Total Energy (J)} = \text{Power (W)} \times \text{Time (s)}$ .

- **Power Density (Irradiance):** Measures the intensity of the light on the surface.

- Formula:  $\text{Power Density (mW/cm}^2\text{)} = \frac{\text{Power (mW)}}{\text{Area (cm}^2\text{)}}$ .

- **Pulsed Laser Calculation:** For pulsed lasers, Average Power is often used in the formula, but pulse frequency and duration are crucial.

- Formula:

$$\text{Power Density (mW/cm}^2\text{)} = \frac{\text{Peak Power} \times \text{Pulse Duration} \times \text{Frequency}}{\text{Area}}$$

- **Alternative Recommendations:** Due to potential inaccuracies with area calculation, some sources recommend using Total Energy in Joules (J) to standardize dosages across studies. ⌘

### Key Parameters

- **Wavelength:** Usually in the red to near-infrared range (630–1000 nm).
- **Power:** Typically 1–500 mW.
- **Duration:** Depends on the required energy density and spot size. ⌘

**Treatment Time:** Calculating how long to apply the laser to reach a target dose.

- $Time (s) = \frac{Target\ Energy (J)}{Power (W)}$

**Average Power (for Pulsed Lasers):** LLLT often uses pulses to avoid heat; the effective power is a fraction of the peak.

- $P_{avg} = P_{peak} \times Frequency (Hz) \times Pulse\ Duration (s)$

## Clinical Context

- **Typical Dose:** Therapeutic windows usually range between **1 J/cm<sup>2</sup> and 10 J/cm<sup>2</sup>** for biostimulation .
- **Wavelength:** While not in the primary dosing equation, wavelength (typically **600nm–1000nm**) determines penetration depth and which tissues absorb the energy .
- **Application:** If a 50 mW (0.05 W) laser is used, a 2 J dose requires 40 seconds ( $\frac{2J}{0.05W}$ ).