Photobiomodulation: Deep Tissue Laser Therapy

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Introduction

Deep Tissue Laser Therapy uses a process called photobiomodulation to change the condition of damaged tissue by stimulating cellular metabolism, thereby accelerating the healing process. As light pours into the tissue, photons will be scattered, reflected and absorbed. Lasers operating in the near-infrared spectrum from 650 to 1300 nanometers can penetrate to deep tissue structures. Light that penetrates into the tissue can be absorbed by melanin, hemoglobin, oxyhemoglobin, and water. Energy from these absorption events will be dissipated as heat, generating a soothing warmth in the tissue.

The primary target for photobiomodulation is the Cytochrome C complex which is found in the inner membrane of the mitochondria. Cytochrome C is a vital component of the electron transport chain that drives cellular metabolism. As light is absorbed, Cytochrome C is stimulated, leading to increased production of ATP, the molecule that facilitates energy transfer within the cell. In addition to ATP, laser stimulation also produces free nitric oxide and reactive oxygen species. Nitric oxide is a powerful vasodilator and an important cellular signaling molecule involved in many physiological processes. Reactive oxygen species have been shown to affect many important physiological signaling pathways including the inflammatory response. In concert, the production of these signaling molecules has been shown to induce growth factor production, to increase cell proliferation and motility, and to promote extracellular matrix deposition and pro-survival pathways. Outside the cell, nitric oxide signaling drives vasodilation which improves microcirculation in the damaged tissue, delivering oxygen, vital sugars, proteins, and salts while removing wastes.

The recent development of higher-power, Class IV systems affords the clinician the ability to efficiently deliver adequate doses of light deep into tissue to reduce pain, reduce inflammation, and accelerate healing. Additionally, the development of a contact treatment applicator can be used to compress superficial tissues, displacing excess fluid and enhancing laser penetration to deep structures.

Clinical Applications & Endorsements

Laser Therapy is endorsed by professional clinical organizations, including the World Health Organization (WHO), American Physical Therapy Association (APTA), and the International Association for the Study of Pain (IASP®) and over 3,000 research studies have been conducted in the field. Deep Tissue Laser Therapy can be used to treat pain and inflammation associated with the following conditions:

- Bursitis
- Disc Issues
- Epicondylitis
- Low Back Pain
- Neck Pain
- Neuropathy
- Plantar Fasciitis
- Sciatica
- Shoulder & Knee
- Sports Injuries
- Sprains & Straings
- Tendonitis & Tendonosis

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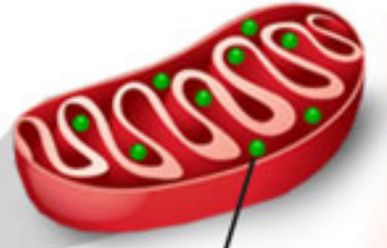
A MECHANISM OF LASER THERAPY IN TISSUE



cytochrome *c* oxidase

Mitochondria

ATP

An increase in ATP, the main energy source for the majority of cellular functions, **increases the cell's ability to fight infection and accelerates the healing process**

ROS

The modulation of ROS activates transcription factors **positively impacting cellular repair and healing**

NO

The release of NO, a potent vasodilator, **increases circulation, decreases inflammation** and enhances the **transport of oxygen and immune cells** throughout the tissue

1 Laser light at a wavelength of 670nm, 808nm or 904nm is delivered to the tissue via a probe in **contact mode** with the surface of the skin.

2 The light enters the cell's mitochondria and is absorbed by the chromophores, including the protien cytochrome *c* oxidase (CCO) which then **increases its activity.**

3 As a result of this heightened activity, three molecules are affected: Adenosine Triphosphate (ATP), Reactive Oxygen Species (ROS) and Nitric Oxide (NO)