



# Understanding Photobiomodulation

The Science Behind How MLS Laser Therapy Works

# Photobiomodulation

LASER IS LIGHT

LIGHT IS ENERGY

ENERGY INTERACTS WITH TISSUE  
INDUCING BIOLOGICAL EFFECTS

Analgesic  
Effect

Anti-inflammatory  
Effect

Biostimulating  
Effect

## Primary and Secondary Effects of Laser

### **Primary Effects**

Photothermal

Photochemical

Photomechanical

### **Secondary Effects**

Cellular

Tissue

Systemic

# Photothermal Primary Effects

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**Conversion  
from laser  
wavelengths  
into thermal  
energy**

**Increase in  
circulation**

**Increased  
speed of  
catabolite  
removal**

**Increase  
supply and  
devlivery of  
oxygen and  
nutrients**

# Photochemical Primary Effects

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**Law of Photochemistry:**  
Light must be absorbed by a chemical substance in order for reaction to take place.  
In the body, that's respiratory enzyme cytochrome c oxidase (involved in electron transport chain in mitochondria)

Laser also absorbed by chromophores (melanin, hemoglobin, water, proteins, etc)

Enzymatic activation and changes in pain perception threshold

Modulation of cellular metabolism: Na-K pump

Increase in ATP production

# Photomechanical Primary Effects

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**Production of  
Extracellular  
matrix (tissue  
repair and  
regeneration)**

**Maintenance of  
homeostatis of  
tissue**

**Re-absorption  
of edema**

**Reactivation of  
microcirculation**

# Secondary Effects

## Effects on cells

**Increases ATP synthesis**

**Increases Myo-B  $\alpha$ -enolase, regulating and mediating reconstruction of damaged muscle fibers**

**Increases Extracellular matrix and encourages remodeling**

**Increases NLRP-10 (anti-inflammatory protein)**

## Effects on tissue

**Increases PPI protein and alkaline phosphate activity**

**Increases actin and tropomyosin**

**Increases Galectin  $\alpha$ -3 and HNRNP K proteins (induces angiogenesis and regenerates nerve fibers)**

**Reduced edema reabsorption times**

**Prevents formation of scare tissue**

# Systemic Secondary Effects

## Analgesic effect

**Blocks pain stimulus conduction**

**Washes out allogenic substances like histamine**

**Increases endorphin synthesis**

**Modulates pain stimulus**

## Anti-inflammatory effects

**Induces vasodilation**

**Encourages permeability of lymphatic capillary vessels**

**Washes out and inhibits pro-inflammatory molecules**

## Bio stimulation

**Increases nutrients, oxygen, and growth factors**

**Activates cell functions (metabolism)**

**Induction and recovery of muscle fibers**

**Induction and recovery of nerve endings**

**Reduces scar tissue formation**



# Metabolic: Functional and reparative effects

