

Laser Therapy Biological Effects

Laser therapy uses high-intensity light to accelerate the body's natural healing processes. The laser beam is moved over the skin so that the light energy penetrates the tissue where it interacts with various molecules that cause different effects within the body. It produces photochemical, photothermal, and photomechanical effects.

A photochemical reaction is a chemical reaction caused by the absorption of energy in the form of light.

This results in the following within the body:

- Enzymatic activation
- Increase in ATP (energy) production
- Modulation of cellular metabolism
- Effect on pain perception threshold

Photothermal Effect occurs when a laser is focused on tissue, resulting in energy being absorbed within and between cells. Heat is then generated. This results in increased circulation to the area.

Photothermic interaction is based on the conversion of optical radiation into thermal energy which, at a microscopic level, occurs through the inelastic encounter between excited molecules following the absorption of photons.

- Increase in blood flow to the area
- Increased supply of oxygen and nutrients to promote healing

Photomechanical Effect is the change in the shape of a material when it is exposed to light.

The absorption of energy involves the formation of mechanical waves.

- Production of an extracellular matrix (important in tissue repair & regeneration)
- Acceleration of lymphatic peristalsis

- Re-absorption of edemas
- Reactivation of microcirculation

Effects on Cells

- Increase in ATP (energy) synthesis
- Increase in the production of RNA
- Increase in cellular proliferation
- Induction of differentiation processes
- Release of growth factors (fibroblasts) and other substances
- Increase in the production of molecules of the extracellular matrix (fibroblasts & chondrocytes)

Effects on Tissue

- Modulation of the inflammatory processes
- Remodeling of the extracellular matrix
- Induction of lymphatic and vascular regeneration
- Stimulation of the endothelial function
- Reduction of the edema re-absorption times
- Prevention against the formation of scar tissue and hyperkeratotic lesions

Systemic Effects

Analgesic effect:

- Blocking of pain stimulus conduction
- Hyperemia and “wash out” of the algogenic substances
- Increase in endorphin synthesis
- Pain threshold modulation

Anti-inflammatory and anti-edema effect:

- Increase in the caliber and modulation of lymphatic and capillary vessel permeability
- Hyperemia and “wash out” of the pro-inflammatory molecules

Biostimulating effect:

- Increase in the supply of nutrients, oxygen, and growth factors
- Cellular function activation
- Modulation of cell proliferation and differentiation (e.g., nerve regeneration)
- Increase of matrix protein synthesis
- Reduction of scar tissue formation