

Photobioactivation



Light is energy of life

Photobioactivation is a term applied to a light stimulus that initiates and/or accelerates a physiological response. Other stimuli used in medicine, for example, are temperature, ultrasound, electrical power, electromagnetic fields, etc.

Laser Therapy was discovered in the 60ies. Today, thousands of clinical evaluations and over 100 double blind studies confirm its efficiency in:

- Wound healing
- Anti-inflammatory effect
- Analgesia
- Improvement of regenerative processes
- Resorption of oedema

These effects can be observed particularly in dermatology, surgery, rheumatology, traumatology, ortho-pedics, gynecology, urology, neurology, dental medicine and veterinary medicine.

Laser Therapy devices (Low Level Lasers up to approx. 500 mW [milliwatts] power output) do not have a thermal effect. This means they provoke neither immediate visible skin reactions nor heat reactions during therapy. Laser Therapy is a soft therapy without side effects. This contrasts the use of surgical application of LASERS, which coagulate, vaporize and carbonize tissue with their high-energy rates (3 to <50 Watts).

Photochemical effect

The laser energy is absorbed by metabolically active pigments of the mitochondria in various cutaneous and subcutaneous layers: here involved are the two enzymes of the oxidation chain, cytochrome *a/a3* and flavoprotein with an absorption maximum of the wavelengths applied.

It is supposed that the changes in the stereochemical conformation induced by an electro magnetic field leads to an increase in activity and improves the concentration of ATP by up to 200%. In addition, an increase in oxygen and glucose metabolism is observed. The main effect is an optimized function of the Na-K pump at the cell membrane, an increased protein synthesis (prostaglandin, enzyme) and a significantly higher rate of mitosis.

Depending on the stimulated type of cells, the following cellphysiological reactions are observed:

Regenerative effect

- Enhanced fibroblast formation and collagen synthesis with improved tissue strength values

- Neovascularization of lymphatic and blood vessels as well as vasodilatation improve microcirculation and lymphatic drainage (resorption of oedema)
- Larger quantity of granulation tissue and accelerated epithelization
- Increased activity of osteoblasts promote the formation of callus
- Regulation of muscle tissue because of ATP-increase
- Prevention of central nerve degeneration and regeneration of peripheral axons after injury

Analgesic effect

- Measurable changes in the potential of nerve cell membranes lead to its hyperpolarization as a good analgesic mechanism
- Improved release reaction of β -endorphins
- Changes in transmitter concentration at the synapsis
- Relaxation of muscle with a decrease of sensibility of the tendon receptors

Effect on the immune system (immune modulation)

- Activation of proliferation of immune cells including macrophages
- Immune suppressive effect by reduced antigen perception of the T-lymphocytes (increased acceptance of a transplant)

Optical window of the skin

The skin is a non-homogenous tissue and yet shows in its spectral analysis an optical window with an optimal transmission capability of light between >600 nm (visible red) and <1200 nm (infrared). Wavelengths (colours) outside of this optical window are mostly being absorbed before they reach deeper layers.

Optical window of the skin

