

Unique method for wound healing and pain relief

- Significantly shorter healing times
- Medically proved efficacy

What does BIOPTRON Light Therapy actually do?

What is BIOPTRON Light?

BIOPTRON Light Therapy System emits light characterized by:

1) Polarization

BIOPTRON Light is polarized light, its waves move (oscillate) on parallel planes. Linear polarization by reflection (the multi-layer mirror system, Brewster mirror), is very efficient and attains a polarization degree of 95%.

2) Polychromacy

BIOPTRON Light Therapy System encompasses the wavelength range from 480 nm to 3400 nm. This spectrum contains the visible light range and a proportion of infrared radiation. The electromagnetic spectrum of BIOPTRON Light does not contain ultraviolet (UV) radiation.

3) Incoherency

BIOPTRON Light is incoherent or "out-of-phase" light. In other words, the light waves are not synchronized.

4) Low-energy

BIOPTRON Light Therapy System has a low energy density (fluency) of an average of 2.4 J/cm^2 . BIOPTRON Light reaches the area to be treated with a constant, steady intensity. This energy density has biostimulative effects.

With BIOPTRON Light Therapy, the energy density dosage can be precisely determined. Furthermore, the effect exerted by light is also defined by its power density. As it is measured at the skin's surface, it varies depending both on the intensity of the light's source and its distance from the area to be treated. The specific power density of BIOPTRON Light is approximately 40 mW/cm^2 at a treatment distance of 10 cm. This is equivalent to an energy density (fluency) of an average of 2.4 J/cm^2 per minute.

These properties of BIOPTRON Light allow it to penetrate the surface of the skin with minimum heating effect, no damage to skin, and no known side-effects.

BIOPTRON Light Therapy System – medical devices, with expanding clinically proved efficacy both in the treatment of wounds and pain conditions and in the treatment of selective skin disorders (wound management).

BIOPTRON Light employs a combination of infrared and visible light wavelengths considered to be beneficial in the treatment of different types of problems and injuries. Both visible and infrared light have been shown to affect different positive changes at cellular level.

Biostimulative effects of BIOPTRON Light are the result of synergy between different mechanisms of action:

- 1) HARMONIZE METABOLIC PROCESSES
- 2) REINFORCE THE HUMAN DEFENCE SYSTEM
- 3) STIMULATE REGENERATIVE AND REPARATIVE PROCESSES OF THE ENTIRE ORGANISM
- 4) PROMOTE WOUND HEALING
- 5) RELIEVE PAIN OR DECREASE ITS INTENSITY



Schematic illustration of a cell

Main mechanisms of the action of light therapy:

The scientific mechanisms underlying various light therapy treatments are still under investigation. However, in general scientists have identified various biological effects that can be initiated and achieved as a result of light stimulation. These include:

- 1) Stimulation of neoangiogenesis. Improvement of microcirculation.
- 2) Increasing the process of phagocytosis.
- 3) Stimulation and activation of ATP production.
- 4) Enhancement of important specific enzymes involved in cell regeneration.
- 5) Increasing the activity of lymphatic system.
- 6) Activation of fibroblast activity and increasing the production of collagen.
- 7) Increasing DNA and RNA production.
- 8) Reducing the excitability of nervous tissue and increasing the muscle relaxation.

BIOPTRON Light Therapy in wound healing and tissue repair

Care for population with chronic wounds is a growing challenge

Wound healing

ULCUS CRURIS (LEG ULCERS)

BURNS

PRESSURE SORES (DECUBITUS)

Chronic wounds are underestimated by physicians and general public alike, yet their prevalence continues to increase dramatically because of the steady growth of the elderly population and because the elderly are at increased risk in respect of the chronic condition predisposing to chronic wounds.

The need to care for population with chronic wounds is a growing challenge that requires innovative approaches. We believe that the use of BIOPTRON Light Therapy alone and in conjunction with existing procedures could greatly enhance the natural wound-healing process. Furthermore,

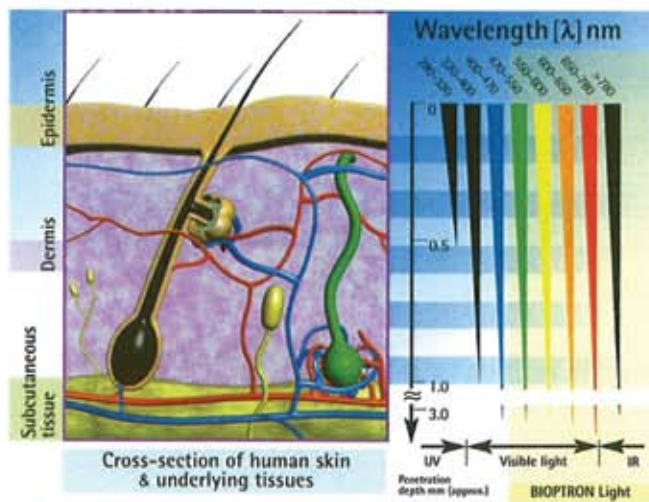
POST-TRAUMATIC WOUNDS

POST-SURGICAL WOUNDS

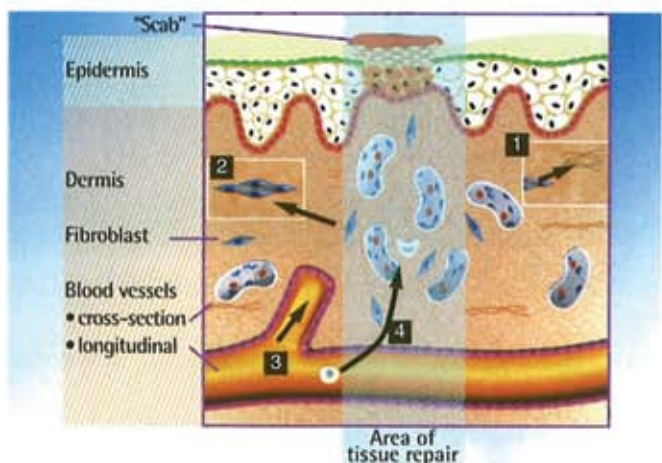
improved wound healing could reduce the risk of infection for the patient, decrease the number of costly dressings required, and more swiftly return the patient to a pre-injury/illness level of activity.

BIOPTRON Light Therapy System provides new insight into the management of leg ulcers, diabetic foot ulcers, burns and wounds following operation and injury. Patients are now able to receive innovative wound-care management. BIOPTRON Light Therapy could offer significant support in conjunction with standard wound-care.

Light penetration into tissues



Cross-section of healing processes in a skin wound



1. Collagen synthesis from fibroblasts / 2. Fibroblast proliferation
3. Growth of new blood vessels / 4. Migration of macrophages

Pain treatment

PHYSIOTHERAPY

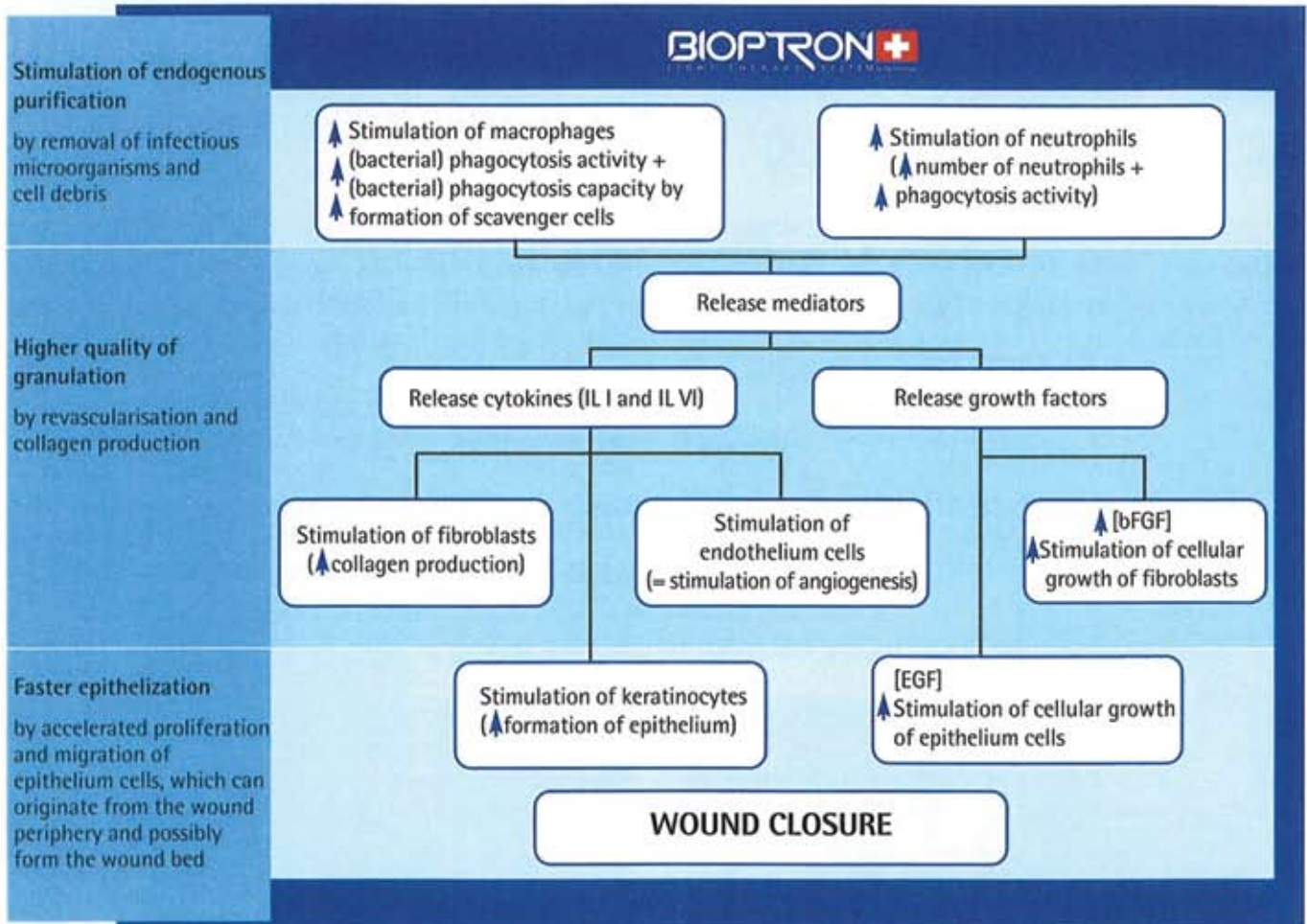
RHEUMATOLOGY

SPORTS MEDICINE

The success of light therapy on pain and functions may be due to a number of mechanisms, one of which may be through its positive effect on chondrocyte proliferation and matrix's synthesis. Also, significant stimulatory effect on fibroblast action and enhanced connective tissue repair

were noted. These effects seem to be related to the biostimulative effect of light therapy at the cellular level. Normalization of microcirculation and speed of nerve transmission achieved have been reported to interrupt the vicious circle of origin and development of pain.

Wound healing involves a highly complex set of physiological processes regulated by many different cellular and humoral factors.



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 Source: Bolton, P., Dyson, M., Young, S. The effect of polarized light on the release of growth factors from the U-937 macrophage-like cell line. *Laser Therapy* 1992; 33-37.

The complex process of wound healing can be influenced by BIOPTRON Light Therapy.

In spite of the positive clinical experiences reported in numerous publications, the mechanism of the biological effect of polarized light is still under investigation. It is assumed that, in the cell membranes, the polar heads of the lipid bilayer are reordered by polarized light and that, as a consequence, functional changes take place.³

Different biological effects have been observed after light therapy, including the stimulation of cell proliferation – especially in fibroblasts, the release of growth factors and the enhancement of collagen synthesis.^{3,4,5} A number of clinical studies have revealed accelerated wound closure with increased wound epithelization and improved tensile strength of scars.⁴⁻⁷

One proposed mechanism of action of photobiostimulation is the absorption of visible light by mitochondria.⁸ This may cause a chain of reactions on molecular level, leading to an

increase in cell energy and activation of the nucleic acid synthesis, which is essential for wound repair. The second proposed mechanism is obtained by the infrared portion of the light spectrum. This initiates the response at the membrane level, probably through photophysical effects on Ca⁺⁺ channels.⁹ Light therapy has been shown to stimulate release of the growth factors from the irradiated cells. Growth factors stimulate angiogenesis, extracellular matrix production and degradation and cytokine release.¹⁰ The key cells in skin ulcer contraction and collagen synthesis are fibroblasts and keratinocytes. A number of studies have demonstrated their activation and proliferation in response to low-energy laser/photon stimulation.

Other mechanisms that may be responsible for the light's therapeutic effect is the local peripheral vasodilatation, which may enhance skin blood flow and supply of oxygen to the ulcer area, thereby facilitating the transportation of the nutrients required for ulcer healing.¹⁰