

# Phototherapy

Phototherapy is a physical therapy that uses both visible and invisible part of the light spectrum (UV, IR) for preventive and therapeutic use. Its original dependence on meteorological conditions (solar radiation) led to the development of artificial light sources. Their development enabled a deeper study of the effects of light radiation on a living cell and demonstrated the dependence between the wavelength of the light rays and the organism's response.

## Historical Notes On Therapeutic Laser Phototherapy

The development of spas, the building of well-known seaside resorts in high-altitude environments enabled doctors to recommend to their patients for long-term stays in the mountains. The clean air combined with sunbathing was used as a treatment method (heliotherapy, which is part of climatotherapy), which we still use today mainly for prevention. In the therapeutic use of sunlight, we must never forget the effects of the ultraviolet (5%) and infrared components (45%) of sunlight, even though the majority (50%) is light in visible wavelengths. An interesting historical fact is that of the awarding of the Nobel Prize to Professor Nielsen Ryberg Finsen for phototherapy in 1903.

Phototherapy experienced major development at the turn of the 20th and 21st centuries, especially with the expansion of physically modified laser sources and so-called lamp phototherapy, where visible incoherent polarized light of a certain wavelength is used.

## Present

Modern phototherapy uses electromagnetic radiation of different wavelengths, which have different effects on the living organism. While some of them have been used for decades (e.g. infrared light), others have only been used in medicine in recent years. Here we mean mainly polarized light sources and lasers, whose radiation has an analgesic, anti-inflammatory and stimulating effect.

## Laser Phototherapy

According to the power of the light beam, we divide lasers into non-invasive - referred to as therapeutic or biostimulating (with power usually up to 500 mW) and invasive - surgical (with power over 1 W). Physically modified laser sources of low power emit so-called soft laser beams, which have a significant biostimulating effect. Invasive lasers have high power and have a destructive effect on selected tissues. The photothermal effect is used in particular, when, for example, light absorbed in pigmented areas is transformed into heat, which destroys the surrounding cells (removal of hyperpigmentation, nevi, hair removal, etc.). Its wavelength is important for the penetration of laser radiation into tissues, which determines the percentage of radiation absorption by the tissues through which it passes. Water and blood minimally absorb laser radiation with a wavelength between 620 and 904 nm. It therefore plays a key role in the skin's melanin, which absorbs the most laser rays in the range of 500 to 780 nm.

Lasers are designed either for spot application, where the beam is guided into a pencil probe, or in the form of scanners, in which the beam is oscillated over the relevant area. The laser medium in which the beam is emitted is a semiconductor or a gas composed of helium and neon. With respect to tissue permeability, lasers with a wavelength of 627 - 780 nm are used more in dermatology, gynecology and dentistry, and lasers with a longer wavelength in rehabilitation, balneology and neurology.

## Visible Polarized light Phototherapy

Unlike lasers, polarized light sources do not emit monochromatic light. The emitted polychromatic light has a lower energy output and greater dispersion of rays. The advantage of treatment with polarized light is minimum of side effects.

In contrast to lasers, due to the lower power of these devices, we have to expect a longer application time and a lower depth of tissue penetration. These devices are ideal for the home treatment of skin diseases such as inflammatory skin diseases, eczema, psoriasis, leg ulcers, bedsores, burns, various types of scars, etc. The most modern technique is photonics, which uses almost monochromatic light. In practice, diodes with a narrowed half-width of the emitted color spectrum are used as a photon source. The advantage is the possibility of deep action into the tissue.

## Invasive Phototherapy

High power lasers (referred to as power lasers) and intense pulsed light (IPL) can convert light radiation into heat, which causes thermolysis in the targeted tissue. Lasers act selectively due to a specific wavelength. IPL makes it possible to act on a wide range of disorders at once. The usual indication is pigment changes (caused by photodisruption), epilation of dark hairs and vascular lesions (e.g. panicle varices or telangiectasia).

# Links

## Sources

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- WEDNESDAY, Leos. *Phototherapy, lecture for e-learning 1st Faculty of Medicine UK* [online]. [feeling. 2016-03-12]. <<https://www.facelifting.cz/news/fototerapie-leos-streda/>>

## Additional Materials

- NÁSIROVA, Michaela. *Modern polarized light phototherapy* [online]. ©2011. [feeling. 2014-11-12]. <[http://www.2es.cz/med/\\_layout/download/bl-med.pdf](http://www.2es.cz/med/_layout/download/bl-med.pdf)>