

Low-Level Laser (Light) Therapy (LLLT) in Skin: Stimulating, Healing, Restoring

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Low-level laser (light) therapy (LLLT) is a fast-growing technology used to treat a multitude of conditions that require stimulation of healing, relief of pain and inflammation, and restoration of function. Although skin is naturally exposed to light more than any other organ, it still responds well to red and near-infrared wavelengths. The photons are absorbed by mitochondrial chromophores in skin cells. Consequently, electron transport, adenosine triphosphate nitric oxide release, blood flow, reactive oxygen species increase, and diverse signaling pathways are activated. Stem cells can be activated, allowing increased tissue repair and healing. In dermatology, LLLT has beneficial effects on wrinkles, acne scars, hypertrophic scars, and healing of burns. LLLT can reduce UV damage both as a treatment and as a prophylactic measure. In pigmentary disorders such as vitiligo, LLLT can increase pigmentation by stimulating melanocyte proliferation and reduce depigmentation by inhibiting autoimmunity. Inflammatory diseases such as psoriasis and acne can also be managed. The noninvasive nature and almost complete absence of side effects encourage further testing in dermatology.

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Increasingly, noninvasive therapies for skin disease and skin rejuvenation are being used, especially in Western countries, where relatively high disposable incomes are combined with the desire for an ideal appearance fostered by societal pressures. Although skin is the organ most exposed to light, it still responds well to red and near-infrared (NIR) wavelengths delivered at the correct parameters with therapeutic intent. Low-level laser therapy (LLLT) was discovered in the late 1960s, but only recently has it been widely applied in dermatology. The introduction of light-emitting diode (LED) devices has reduced many of the concerns formerly associated with lasers, such as expense, safety concerns, and the need for trained personnel to operate them. In fact, many

LED devices are designed for home use and are widely sold on the Internet. This review will cover the use of LLLT as possibly the ultimate noninvasive approach to treating the skin.

LLLT and Its Mechanism of Action

LLLT, phototherapy, or photobiomodulation refers to the use of photons at a nonthermal irradiance to alter biological activity. LLLT uses coherent light sources (lasers), noncoherent light sources consisting of filtered lamps or LED, or, on occasion, a combination of both. The main medical applications of LLLT are reducing pain and inflammation, augmenting tissue repair and promoting regeneration of different tissues and nerves, and preventing tissue damage in situations where it is likely to occur.^{1,2} In the past few decades, nonablative laser therapies have been used increasingly for the esthetic treatment of fine wrinkles, photoaged skin, and scars, a process known as photorejuvenation (Table 1). More recently, this approach has also been used for inflammatory acne (Table 1).³ LLLT involves exposing cells or tissue to low levels of red and NIR light. This process is referred to as “low level” because the energy or power densities used are low compared with other forms of laser therapy such as ablation,

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