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Editorial

Treatment with LEDs: A New Perspective in Phototherapy

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The ideal practice of phototherapy should concern a minimized thermal injury or photodamage. On this grounds the effectivity and availability of phototherapy regimens can be comparable as the optimized wavelengths reach the target zone to create an athermal trigger or energy to induce regulating effects.

Phototherapy with light-emitting diode (LED) devices has been studied during the last decade, recently generating evidence based results about photobiomodulation. LED treatments are based on two main stimulating effects: Photodynamic effects and photobiomodulation. In general photobiomodulation can be comparable with cold laser biostimulation or non-ablative laser treatments.

The biostimulatory effect of a LED device is directly related with the (right) wavelength, the (right) hertz (flashing of light/second) and the dosage of photons to activate the cell function. The last parameter determines the target area where clinical results will appear, the wider array of high number of diodes stimulating the more satisfactory changes.

The results of the studies of *Goldberg et al.* and *Lee SY et al.* present the leading evidences of dermal changes induced by LED treatments emphasizing the availability of blue and red light in acne vulgaris and skin rejuvenation [1, 2]. Combination of blue (415 nm) and red (633 nm) LED treatments stimulates cell activities and generates production of cytotoxic singlet oxygen giving rise to destruction of *P. acnes*, and non-ablative skin rejuvenation [3, 4]. Modulation and enhancement of cell function is called photobiomodulation. The main components of photobiomodulation include growth factor production (i.e. fibroblast growth factor, TGF, PDGF), extracellular matrix production, increased synthesis of collagen and procollagen, improvement of microcirculation, stimulation of macrophages and lymphocytes and proliferation of fibroblasts. Radiation of fibroblasts with 633 nm wavelength increases procollagen synthesis fourfold from baseline. Karu has investigated the action of low-power visible light on various cells and established the triggering absorption spectrum of irradiated cells and the changes occurred in their metabolic activities as a result of photosignal transduction [5, 6].

Effects of LED treatment on facial skin involves reductions of moderate wrinkles, improvement of skin texture and tone, firmness and smoothness of the skin. Additionally, LED has a far safer treatment profile than ablative methodologies such as aggressive chemical peeling and laser resurfacing.

LED 630 to 700 nm penetrates tissue to a depth of 10 mm which is helpful for wound healing of cuts, low grade soft tissue inflam-

mations and acupuncture points. Clinical applications of LED include, reduction of wound scars, skin rejuvenation, acne vulgaris, indolent ulcers and treatment of cellulitis [**1, 4, 5, 7, 8, 9**].

Medical treatment remains the gold standard for the treatment of acne vulgaris. However light therapies such as blue light (415 nm) and/or red light (633 nm) LED sources provide new alternatives which support the solutions of cosmetic problems due to mild to inflammatory acne. Propionibacterium acnes produce protoporphyrin IX an coproporphyrin III in the follicular units and causes a transformation from non-inflammatory to inflammatory lesions. The absorption peak for these porphyrins is at 415 nm and is in the blue range and phototherapy devices using blue light for the inflammatory acne vulgaris lesions cause a dramatic reduction in *P. acnes* by direct destruction. The photodynamic process in this reaction starts with the photoexcitation of the porphyrins after exposure to the appropriate light source. Singlet oxygen then forms within the microorganisms resulting in destruction of the bacteria. There are several reports indicating 62 to 74% in mild to moderate acne vulgaris after receiving twice weekly treatments for 4-6 weeks [**3, 10, 11, 12**].

Red light (633 nm), although less effective at activating coproporphyrin III than blue light penetrates more deeply in the tissue and importantly has noticeable anti-inflammatory properties. Red light influences anti inflammatory cytokines from macrophages and synthesis of fibroblast growth factor from photo-activated cells causing various beneficial effects such as stimulation of cell proliferation, collagen deposition and neovascularisation. These results relate more directly to acne anda re promising for rosacea, as well. The anti-inflammatory actions of LED light therapy seem ideal for rosacea lesions [**13**].

The efficacy of blue light in combination with red light causes more effectively a reduction in lesion counts, progressively throughout a 4-week light therapy, with a final average reduction of 69% seen 8 weeks after the treatment course.

LED treatments work well after any procedure that causes erythema and irritation, including chemical peels or ablative laser systems. LED light may be used as a pretreatment for mesotherapy patients in cellulitis setting. 633 nm and 830 nm activate the main metabolic activator ATP in fat cells. Following phosphatidylcholine in the mesotherapy injection, the holes of penetration by which fat cell is infiltrated by the agent, priorly activated cells more efficiently squeeze the fat out through these holes. Another aspect of the availability of LED photobiomodulation may be the prevention of radiation induced dermatitis in breast cancer patients enabling significant reduction in the incidence and severity of the skin reactions. This may result in fewer interruptions to the courses of radiotherapy [**14**].

The 633 nm wavelength has been used with a photosensitizing product (5-ALA) to remove nonmelanoma skin cancers and actinic keratoses. It may also be promising treatment option in recalcitrant erosions due to lichen simplex chronicus or senile pruritus, or to relieve the pruritus symptom in haemodialysis patients since significant evidences have been noted in these indications.

In conclusion LED treatments are promisingly concernable for new treatment indications including reactive changes with the symptoms of inflammation, pruritus or erosions or consequent findings and degenerations such as postinflammatory discoloration or skin aging. Photobiomodulation give rise to an energy boost from the direct athermal exchange of energy between photons and cell components which may help to repair damaged cells, induce mitotic cells to replicate faster while they remain alive and unharmed.

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