

ORIGINAL ARTICLE

## Light-emitting diode 415 nm in the treatment of inflammatory acne: An open-label, multicentric, pilot investigation

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### Abstract

**Background.** The management of acne remains a challenge, with current therapies linked to significant side effects and patient non-compliance. Phototherapy using blue light has been proven in the treatment of acne vulgaris and offers the clinician an effective alternative.

**Objective.** To determine the effect of narrowband light-emitting diode (LED) blue light in the reduction of inflammatory and non-inflammatory lesions in patients with mild to moderate acne and to evaluate patient tolerance of the therapy.

**Methods.** Forty-five patients were treated with high-intensity pure blue light, 415 nm and 48 J/cm<sup>2</sup>, receiving two treatments of 20 minutes per week for a period of 4–8 weeks. Clinical assessment was performed at baseline, and 2, 4 and 8 weeks after treatment. A patient's therapeutic response was measured using a global improvement scoring system.

**Results.** The mean improvement score was 3.14 at 4 weeks and 2.90 at 8 weeks. Nine patients experienced complete clearing at 8 weeks. The treatment was well tolerated, with 50% of patients highly satisfied with the treatment.

**Conclusion.** This open-label study suggests the therapeutic efficacy of high-intensity LED pure blue light in the treatment of acne vulgaris with no reported side effects.

**Key words:** *Acne vulgaris*, narrowband blue light, phototherapy, *Propionibacterium acnes*

### Introduction

Optimal management of acne vulgaris still remains a challenge and currently available therapeutic agents are often associated with significant side effects (1). Photodynamic therapy using aminolevulinic acid has been shown to be effective in treating acne vulgaris (2). The presence of *Propionibacterium acnes* in acne-prone skin is associated with an increased production of endogenous porphyrins in the pilosebaceous units (2). This observation raises the possibility of using a specific and intense light source in order to photoactivate endogenous porphyrins for therapeutic means. The goal of this study was to evaluate the efficacy of light-emitting diode (LED) blue light technology in treating inflammatory acne.

### Materials and methods

A total of 45 patients (31 female, 14 male) affected with mild to moderate inflammatory acne, excluding nodulocystic acne, were recruited after informed consent was obtained. The age of patients ranged from 18 to 51 years (mean: 26 years). Skin

phototypes ranged from I to IV. Patients were treated in three different dermatology centers in southern California following the same protocol. Wash-off periods of 4 weeks and 8 weeks were allowed for topical and oral medications, respectively, before the beginning of treatments. Patients were treated with high-intensity pure blue light (Omnilux Blue Photo Therapeutics, UK), receiving two treatments per week of 20 minutes (415 nm, 48 J/cm<sup>2</sup>) for a period of 4–8 weeks. Clinical assessment was performed at baseline, and 2, 4 and 8 weeks after treatment. A patient's therapeutic response was measured using the following global improvement scoring system: 0: no improvement; 1: 0–25% improvement; 2: 26–50%; 3: 51–75%; 4: 76–100%. A patient's tolerance, side effects and observations were monitored and documented throughout the study period; satisfaction rate was also assessed using a questionnaire.

### Results

Forty-three out of 45 patients completed at least 4 weeks of treatment. Two patients dropped out



Figure 1. Before treatment.

because of schedule conflicts. No patients reported adverse events related to the treatment. The mean improvement score was 3.14 (at 4 weeks) and 2.90 (at 8 weeks). Nine patients experienced complete clearing at 8 weeks. Of the patients surveyed, 10% were not satisfied, 40% were mildly to moderately satisfied, and 50% were highly satisfied with the treatment and results. A significant number of patients reported a decrease in skin oiliness or seborrhea, as well as a perceived decrease in pore size.

## Discussion

The pathophysiology of acne is complex and multifactorial, including the role of hyperseborrhea and pilosebaceous colonization with *P. acnes*. A reduction of those two factors is also associated with improvement of acne severity in patients. *P. acnes* is responsible for the production of endogenous porphyrins, mainly coproporphyrin III and



Figure 3. Before treatment.

protoporphyrin IX that have a spectrum of maximal absorption in the range of 400 to 415 nm. The excitation of endogenous porphyrins by high-intensity specific light sources such as LED blue light has been shown to decrease bacterial count in acne-prone skin. Furthermore, other anti-inflammatory and biomodulating effects have been postulated to explain the role of LED blue light in acne. The treatment efficacy not only relies on the death of *P. acnes* through singlet oxygen production, but also on the stimulatory effect of the light on the cytokine mechanisms. Blue light therapy at 415 nm is known to stimulate the production of cytokines from keratinocytes located in the epidermis. The cytokine cascade is a secondary or dark reaction that continues after the light treatment has finished. This cascade stimulates specific immunoregulatory pathways which play a significant role in the post-treatment healing of inflamed acne skin.

There are a number of reasons why LED blue light therapy should now be seen as a credible



Figure 2. Four weeks after treatment.



Figure 4. Eight weeks after treatment.

treatment modality with growing interest for non-medication acne treatments. Topical and systemic medications are associated with frequent side effects and patient monitoring, and the patient population is now becoming increasingly concerned with Accutane. LED blue light therapy offers an appealing non-invasive alternative for the treatment of acne; it can be conveniently and safely combined with a topical regimen and, combined with Omnilux Revive (LED red light), may provide a successful treatment modality for cystic acne.

### **Conclusion**

This open-label study suggests the therapeutic efficacy of high-intensity LED pure blue light in the

treatment of acne vulgaris with no reported side effects. Additional studies should be conducted in order to further ascertain the optimal treatment parameters and the potential synergistic effect with medications of this new therapeutic device in acne and explore the possibilities of a maintenance regime after the initial treatment phase, to prolong remission.

### **References**

1. Cunliffe WJ, Goulden V. Phototherapy and acne vulgaris. *Br J Dermatol.* 2000;142:853-6.
2. Hongcharu WH, Charles RT, Chang Y, Aghassi D, Suthamjariya K, Anderson RR. Topical ALA-photodynamic therapy for the treatment of acne vulgaris. *J Invest Dermatol.* 2000;115:183-92.