

# Treatment of Acne Vulgaris With Photodynamic Therapy: The Use of Aminolevulinic Acid and Green Light

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Light therapy and photodynamic therapy are increasingly popular therapeutic options for acne vulgaris. Green light lasers, 532 nm, are capable of direct bactericidal effects and of activating the photosensitizer aminolevulinic acid. This type of photodynamic therapy is another reasonable, safe option to add to the arsenal of tools to combat mild to severe inflammatory, papulopustular acne.

Photodynamic therapy (PDT) is a promising therapeutic option for a variety of dermatologic conditions, especially acne vulgaris. Because of evolving bacterial resistance and the perceived negative side effects of traditional acne therapy, a safer, less invasive option is desirable and demanded by patients. Physicians have therefore been exploring PDT in the office setting. Considerable literature has been devoted to light therapy alone, as well as to PDT for acne vulgaris. Unfortunately, there are few reports on green light activation of topical photosensitizers. Green light lasers are a popular tool for treating the cosmetic effects of photoaging and are available in many aesthetic practices. At 532 nm, these lasers are also used as the sole light source when treating acne with light therapy.<sup>1,2</sup> When used alone, green light and violet light have been reported to possess the most effective wavelengths for light-based acne therapy.<sup>3</sup> Green light is well absorbed by bacterial porphyrins and can penetrate 1 to 2 mm into the skin.<sup>4</sup> Thus, it is an effective, direct bactericide

that reaches the depth of the sebaceous glands, where it can activate a photosensitizer.

The history of acne and light therapy is both fascinating and revealing. Initially, Papageorgiou et al<sup>5</sup> described treating acne with various visible wavelengths and reported that a combination of red and blue light proved most efficacious. Treatment of inflammatory acne with the green light laser has been reported to be as efficacious as therapy with oral antibiotics.<sup>2</sup> Hongcharu et al<sup>6</sup> researched therapy with the photosensitizer aminolevulinic acid (ALA) alone and ALA activated with red light. They reported that ALA plus red light caused phototoxicity to sebaceous follicles, prolonged suppression of sebaceous gland function, and apparent decrease in follicular bacteria after PDT. They also reported that PDT inhibited sebum excretion abruptly and that, histologically, the sebaceous glands were smaller and remained so long after PDT.<sup>6</sup> Itoh et al<sup>7</sup> reported efficacy with ALA and a pulsed dye laser. Researchers have used polychromatic visible light, blue light, red light, intense pulsed light, and pulsed dye lasers to activate protoporphyrin.<sup>8</sup>

ALA is the photosensitizer available in the United States. It is preferentially absorbed by the sebaceous glands, where it is metabolized to protoporphyrin.<sup>9</sup> We know that protoporphyrins have absorption peaks in the Soret band (360–400 nm) and smaller peaks in Q bands

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**Figure 1.** Patient 1—front view (A) and left view (B) before treatment, and front view (C) and left view (D) after treatment with photodynamic therapy.

(500–660 nm).<sup>10</sup> When exposed to light at these wavelengths, a single oxygen molecule is produced, along with other free radicals that are cytotoxic.<sup>11</sup> Green light corresponds to one Q band and is efficient in activating ALA. It seems that the bactericidal effects of green light, combined with its ability to activate ALA in the sebaceous glands, would make it ideal for PDT.

## CASE REPORTS

### Patient 1

Patient 1 was a 16-year-old Hispanic female with a 3-year history of moderate inflammatory acne vulgaris (Figures 1A and B). She tried numerous over-the-counter remedies, including benzoyl peroxide and salicylic acid facial washes, as well as prescription antibiotics, including a 6-month regimen with minocycline 50 mg twice daily. She was taking oral contraceptives. Her doctor had urged her to start isotretinoin treatment, but the patient was hesitant because of well-publicized side effects. She and her mother presented to the office hoping to get the acne lasered.

The patient was treated with one PDT session. She was prepared with microdermabrasion and a vigorous

acetone scrub. ALA 25% was painted on her face and allowed to incubate for 60 minutes. A potassium titanyl phosphate YAG laser was then applied using normal acne settings (4-mm spot size, 40-ms pulse duration, and 6-J/cm<sup>2</sup> fluence). A total of 60 J of energy was applied in 10 passes.

The patient reported redness and discomfort the first evening of therapy, with peeling similar to that of a mild sunburn for 2 to 3 days afterward. She returned to the office for a checkup 4 weeks later (Figures 1C and D). Happy with her results, she opted to start topical antibiotic therapy and postpone further laser therapy.

### Patient 2

Patient 2 was a 15-year-old white male with moderate to severe inflammatory acne vulgaris (Figures 2A and B). He had been treated with over-the-counter remedies, as well as prescription topical antibiotics (5% clindamycin–benzoyl peroxide gel twice daily for 6 months) and oral antibiotics (doxycycline 100 mg twice daily for 9 months). He had been treated more than 2 years earlier with isotretinoin capsules for 6 months. His acne cleared



**Figure 2.** Patient 2—full face (A) and right cheek (B) before treatment, and full face (C) and right cheek (D) after treatment with photodynamic therapy.

with isotretinoin, but he did not wish to repeat therapy because of side effects, mainly dryness and discomfort.

The patient was treated with 2 PDT sessions 1 month apart. He was prepared in the same manner as was Patient 1. ALA was applied and incubated for 60 minutes before each session. Eight joules of energy were applied in 5 passes, with 4-mm spot size and 30-ms pulse width using a potassium titanyl phosphate YAG laser. Because of discomfort, only 40 J of energy were delivered with the first session and 45 J with the second. After the first session, the patient reported only minimal erythema and negligible peeling; after the second, however, he reported 1 week of erythema and peeling, and is not eager for more PDT sessions (Figures 2C and D).

### COMMENT

Because of the recalcitrant nature of acne vulgaris and problems with traditional therapies, light therapy and

PDT are intriguing therapeutic options. They have several advantages: they are noninvasive, are usually well tolerated, and can treat many lesions in short sessions.<sup>12</sup> In addition, there are multiple wavelengths of light that work alone or with a photosensitizer, increasing the treatment options available to physicians and patients.

Questions remain regarding optimal light sources, photosensitizers, incubation times, preparatory procedures, number of treatments, and so on. Obviously, ideal parameters have yet to be established; this will be an area of ongoing research. To our knowledge, no reports on using green light in PDT exist. Green light is already used for treating telangiectasias and lentigines, and may have certain advantages when used with PDT for treating acne vulgaris, such as bactericidal activity and achieving sebaceous gland cytotoxicity with one wavelength. It is hoped that future studies will clarify specific guidelines for therapy.

With this article, we hope to add yet another possibility to the myriad available for PDT and increase the options for treating acne vulgaris.

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