Photopneumatic Therapy for the Treatment of Acne

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ABSTRACT

Background: A wide variety of laser and light-based therapies have been utilized for acne vulgaris; however, current techniques have been limited by photosensitivity issues or inconsistent results.

Objective: To determine the clinical efficacy and side-effect profile of photopneumatic therapy for the treatment of facial acne vulgaris.

Methods: Twenty adults with mild to severe facial acne vulgaris received 4 successive treatments at 2-week intervals with a combined photopneumatic device (intense pulsed light [IPL] fluences=3.6-4.2 J/cm², negative pressure=3 psi). Clinical improvement was evaluated on a quartile grading scale using comparative digital photographs at baseline, and 1 month and 3 months after the final treatment. Acne lesion counts were obtained at baseline, prior to each treatment session, and at the end of the study.

Results: Modest reduction in acne lesion counts and global clinical improvement was seen in the majority of patients. Patients with severe acne experienced the most clinical improvement. Side effects were mild and limited to transient erythema and rare purpura. Most patients experienced acne worsening early in the treatment course.

Conclusion: Photopneumatic therapy is a safe and effective treatment for acne vulgaris. Patients with more severe acne respond best to treatment.

INTRODUCTION

Acne vulgaris is a common disease of the pilosebaceous follicle, affecting approximately 40 million US adolescents and 25 million adults. Most patients who seek treatment are socially active women with psychological and physical morbidity associated with acne. The pathogenesis of acne vulgaris is multifactorial; therefore, combined treatment is often prescribed to address as many factors as possible.

Medical and oral therapies, including antibiotics, remain the gold standard of treatment; however, they often have drawbacks, including associated side effects, prolonged course of treatment, and patient compliance issues. Even before the advent of light, laser, and radiofrequency treatments, physical therapeutic modalities have been employed to complement medical therapy. Electrocautery, corticosteroid injection, comedone extraction, chemical peels, and cryotherapy have been used, but the need for frequent maintenance treatments to sustain clinical results limited their usefulness. To overcome these limitations, a variety of laser, light-based, and photodynamic therapies have recently been introduced as adjunctive treatment and/or replacement for systemic medications. These devices include laser and light sources emitting wavelengths ranging from 420 nm to 1540 nm as well as radiofrequency systems. Each modality has its advantages and disadvantages, including inconsistent clinical efficacy.

In order to enhance the effective delivery of intense pulsed light (IPL), a specialized device has been developed that combines negative pressure (or suction) with the concomitant delivery of broadband pulsed light (400-1200 nm). The pneumatic component applies gentle suction pressure which elevates the sebaceous target closer to the skin surface so that its contents can be mechanically removed. Broadband blue (400 nm) light and infrared (1200 nm) light is delivered to achieve bacterial destruction through the photodynamic stimulation of bacterial porphyrins (blue light) and to produce an anti-inflammatory tissue effect (infrared light). The purpose of this study was to evaluate the safety and effectiveness of photopneumatic therapy (IPL) in the treatment of acne vulgaris of varying severities.

METHODS

Twenty adults (2 males and 18 females with Fitzpatrick skin phototypes 1 to 4; aged 16-40 years, mean 28 years) with mild to severe facial acne were recruited for study enrollment. All patients had failed prior topical and systemic therapy. No acne treatment had been used within 3 months prior to the study. Exclusion criteria included concurrent pregnancy or lactation, use of photosensitizing drugs or cyclosporine, history of porphyria or photosensitivity, or required oral antibiotic therapy during the course of study.

Facial skin was cleansed with mild soap and water to remove traces of makeup and debris prior to treatment. No local or other anesthesia was used. To minimize treatment discomfort, a commercially-available cryogen spray (TipSpray; Aesthera Corp, Pleasanton, Calif) was used to cool the treatment tip before skin irradiation and after every 3 to 5 pulses. All subjects received 4 successive treatments at 2-week intervals with the
combined photopneumatic device (Isolaz™, Aesthera Corp, Pleasanton, Calif) by a single operator. Filter tips of 400 nm and 580 nm were used for skin types 1 to 3 and skin type 4, respectively. Concurrent negative pressure (pneumatic energy) of 3 psi was applied concomitantly with the delivery of fluences ranging from 3.6 to 4.2 J/cm² in a single pass to the entire face. A second pass using identical treatment parameters was applied to individual acne lesions as indicated by clinical exam. No postoperative analgesics were required. Patients were instructed to follow their usual skin care regimens throughout the course of the study.

Clinical improvement of comparable digital photographs was evaluated by 2 masked medical assessors on a quartile grading scale (0 = no improvement, 1 = 1%-25% improvement, 2 = 26%-50% improvement, 3 = 51%-75% improvement, 4 = 76%-100% improvement). All photographs were obtained using identical camera settings, lighting, and patient positioning at baseline (pretreatment) and 1 and 3 months after the final (fourth) treatment. The mean of 3 individual acne lesion counts were obtained at baseline, prior to each treatment session, and at the end of the study.

RESULTS

Intraoperative discomfort was described as mild-to-moderate by most patients. Posttreatment, mild transient erythema was observed in all patients which completely resolved within hours of treatment. One patient with severe acne experienced purpura after the first treatment, presumably due to overzealous use of negative pressure in the sensitive infraorbital skin regions.

Eighteen patients (90%) completed the study. Acne lesion counts and clinical improvement scores indicated marked improvement in acne and overall skin appearance in most patients (Table 1). The greatest improvement was noted in patients with severe acne (Figure 1). Clinical improvement was observed after the second treatment in most patients. Worsening of acne was often experienced within the first week after treatment and persisted for 5 to 7 days. No cases of persistent erythema or acne recurrence were observed after treatment. No other adverse effects such as vesiculation, dyspigmentation, scarring, or photosensitivity were demonstrated.

DISCUSSION

Despite the wide variety of acne treatments available, including topical and systemic medications, chemical peels, and laser and light irradiation, there are patients who remain unresponsive to therapy. The study described herein demonstrates the safe and effective use of a novel photopneumatic device for mild to severe facial acne vulgaris. While others have previ-

<table>
<thead>
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<th>Acne severity (n)</th>
<th>Average acne lesion counts</th>
<th>Clinical improvement scores</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Pretreatment</td>
<td>Posttreatment #1</td>
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<tr>
<td>Mild (8)</td>
<td>14.5</td>
<td>12.3</td>
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<tr>
<td>Mild to moderate (2)</td>
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<td>14.5</td>
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<td>Moderate (6)</td>
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<tr>
<td>Severe (2)</td>
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Clinical improvement was evaluated on a quartile grading scale (0 = no improvement, 1 = 1%-25% improvement, 2 = 26%-50% improvement, 3 = 51%-75% improvement, 4 = 76%-100% improvement).

FIGURE 1. An 18-year-old man with severe facial acne at baseline (a). Clinical improvement noted 2 weeks after 1st treatment (b), 2nd treatment (c), 3rd treatment (d), and 4th treatment (e).
Thermally-injured bacteria, as well as direct thermal injury to pilosebaceous units during the treatment of acne vulgaris.1 This is the largest and most inclusive (eg, severe acne) study with the longest posttreatment evaluation demonstrating the effect of the device for this condition. Mechanisms that have been proposed for the device's success include reduction of Propionibacterium acnes by 400-nm blue light and an anti-inflammatory tissue effect by red light.8 In addition, the pneumatic (negative pressure) aspect of the device stretches the skin to reduce the concentration of competitive chromophores (eg, melanin, hemoglobin) so that the sebaceous gland can be irradiated more efficiently.

Ultrastructural changes to pilosebaceous units have been studied during photopneumatic acne treatment.9 Mechanical extraction of comedonal contents from the infundibulum has been observed histologically immediately following the first treatment. Thermally-injured bacteria, as well as direct thermal injury to pilosebaceous units, have also been noted 1 week after a second treatment. These ultrastructural changes correlate with the clinical improvement observed after the second treatment in our study.

One shortcoming of photopneumatic therapy is worsening of the acne which is often experienced within 2 to 3 days after treatment. Possible causes of lesion worsening include: in complete comedone removal or comedonal rupture during application of negative pressure suction, leading to development of tissue inflammation and inflammatory lesions. It is, therefore, advisable to inform patients about the possibility of acne flare-ups during the course of treatment in order to set realistic expectations of the procedure.

A drawback of our study was that longer posttreatment evaluations were not formally conducted. Patient recruitment for study entry was rendered impossible without providing an option at 3 months for cross-over treatment of the contralateral (untreated) facial half. All of the patients who completed the study opted for the cross-over treatment. It was interesting that during the 3 months of cross-over treatment, none of the initially treated facial halves demonstrated acne recurrence.

CONCLUSION

Photopneumatic therapy is a safe and effective treatment for mild to severe acne vulgaris. Patients with mild to moderate acne should be forewarned about the possibility of acne exacerbation early in the treatment course. Patients with more severe acne respond best to treatment. Controlled studies with larger treatment groups and longer follow-up periods are warranted to fully evaluate this treatment for acne.

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REFERENCES


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