

Sebum-Selective 1,726-nm Laser Therapy for Papulopustular Rosacea Associated with *Demodex* Mite Proliferation: A Case Report

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Abstract: Papulopustular rosacea is a chronic inflammatory condition of the pilosebaceous unit, with an unclear exact cause, but it is thought to involve an exaggerated immune response, persistent inflammation, and possibly an increased presence of *Demodex* mites on the skin. This is a case report of a 22-year-old woman with papulopustular rosacea treated with a 1,726-nm sebum-selective laser over three sessions. Progressive clinical improvement was observed, with a reduction of inflammatory lesions from 234 at baseline to complete clearance, along with improvement in erythema, flushing, and patient-reported symptoms. *Demodex* density decreased from 58 mites/cm² to 12 mites/cm². Treatment was well tolerated, with no adverse events and high patient satisfaction. These findings suggest that sebum-selective laser therapy may offer a non-pharmacologic treatment option for papulopustular rosacea, potentially by modulating sebaceous gland activity. Further studies are needed to confirm efficacy and clarify mechanisms.

Plain Language Summary: Rosacea is a common skin condition that causes facial redness, flushing, and acne-like bumps, often with burning or stinging. In this case, a 22-year-old woman was treated with a laser that targets oil glands in the skin. After three sessions, her skin improved significantly, with complete clearing of bumps and reduced redness and symptoms. The number of *Demodex* mites also decreased. The treatment was well tolerated with no side effects. This laser may be a useful option for patients who are resistant to conventional treatments, unable to use standard medications, or for whom it serves as an adjunctive therapy; however, further research is needed to confirm its effectiveness.

Keywords: *Demodex* mite, rosacea, demodicosis, 1, 726-nm laser, sebum-selective laser

Introduction

Rosacea is a chronic inflammatory dermatosis of the central face, characterized by flushing, persistent erythema, papules, pustules, telangiectasia, and occasional phymatous changes, with possible ocular involvement. Owing to its facial distribution and chronic course, rosacea can significantly impair quality of life. Management includes appropriate skin care, topical and systemic therapies, and, for selected features, energy-based treatments such as intense pulsed light, laser therapy, and surgery.^{1,2}

The pathogenesis of rosacea is multifactorial, involving dysregulation of innate and adaptive immunity, neurovascular dysfunction, and abnormalities of the pilosebaceous unit, with an important contribution from microbial factors. Key pathways include activation of toll-like receptor 2 and the NLRP3 inflammasome, abnormal processing of cathelicidin (LL-37), and neurocutaneous signaling via transient receptor potential channels.²

Among these microbial contributors, *Demodex* mites have been strongly implicated in rosacea, especially papulopustular rosacea (PPR). Multiple studies have demonstrated significantly higher *Demodex* densities in patients with rosacea compared with healthy controls, and mite density has been shown to correlate with inflammatory lesion severity.³⁻⁷

Demodex mites contribute to inflammation through follicular obstruction, disruption of the epidermal barrier, activation of Toll-like receptor-mediated innate immune pathways, and immune responses to mite-associated bacteria.^{3,8,9} The clinical efficacy of acaricidal therapies, particularly topical ivermectin, further supports the pathogenic role of *Demodex* in rosacea.^{10,11} Sebaceous gland activity is central to maintaining the follicular microenvironment that supports *Demodex* survival and proliferation. Sebum provides a primary nutritional substrate for mites and contributes to cutaneous inflammation by altering lipid composition and inducing oxidative stress.¹²

Oral isotretinoin, which suppresses sebaceous gland activity and reduces sebum production, has demonstrated efficacy in rosacea. Its mechanisms include modulation of gene expression, reduction of sebaceous gland size, and anti-inflammatory effects, thereby addressing key aspects of immune dysregulation in rosacea.^{13–15} Isotretinoin therapy has also been associated with reductions in *Demodex* mite density.^{16–19} Collectively, these observations support targeting sebaceous gland function as an effective therapeutic strategy for rosacea.

Despite its efficacy, isotretinoin use is limited by systemic adverse effects, prompting interest in non-pharmacologic approaches that modulate sebaceous gland activity. While laser and energy-based devices are well established for vascular features of rosacea, sebaceous gland-targeted therapies remain relatively underexplored in rosacea management. The 1,726-nm wavelength corresponds to a lipid absorption peak, allowing selective photothermal targeting of sebaceous glands while minimizing absorption by water and hemoglobin. This sebum-selective mechanism has been shown to reduce sebaceous gland activity and inflammatory lesions in acne vulgaris, providing a mechanism of action analogous to isotretinoin without systemic exposure.^{20,21} However, evidence for the use of 1,726-nm lasers specifically in rosacea remains limited.

This case demonstrates progressive clinical improvement accompanied by a reduction in *Demodex* mite density following treatment with a 1,726-nm laser, highlighting a potentially novel, mechanism-based therapeutic approach for papulopustular rosacea. This modality may represent a potential adjunctive or alternative option within current treatment algorithms, particularly for patients who are intolerant of or reluctant to use long-term topical or systemic therapies.

Case Report

A 22-year-old woman presented with two years history of recurrent facial flushing and persistent background erythema, accompanied by stinging sensations. These symptoms were precipitated by sunlight exposure, hot weather, and physical exertion.

The patient was otherwise healthy, with no known chronic medical conditions and no history of regular medication use. Approximately three months prior to presentation, she developed persistent central facial erythema, flushing, and telangiectasia, accompanied by skin dryness, stinging, burning, and intermittent pruritus (Figure 1).

Subsequently, multiple small erythematous papules and pustules appeared on the nasal area and progressively extended to the cheeks and forehead (Figure 2).



Figure 1 Baseline clinical presentation showing persistent background erythema and facial flushing involving the central face.



Figure 2 Multiple small papulopustular lesions symmetrically distributed over the cheeks, chin, and forehead on a background of erythema and telangiectasia.

Physical examination revealed numerous small papulopustular lesions on a background of diffuse erythema and flushing involving both cheeks and the forehead, without the presence of comedones. To evaluate the density of *Demodex* mites, a standardized skin surface biopsy (SSSB) was conducted on the affected areas of the right cheek. This procedure showed a *Demodex* density of 58 mites/cm² on the right cheek. In addition, superficial needle scraping (SNS) was performed by gently scraping five pustular lesions using the convex surface of a 22-gauge needle. Microscopic examination of the collected material revealed 6 *Demodex* mites (Figure 3).

Based on the clinical presentation and parasitological findings, a diagnosis of papulopustular rosacea associated with increased *Demodex* mite density was established.

The patient declined systemic pharmacologic therapy and was reluctant to use topical treatments because of persistent facial skin sensitivity and concerns about further irritation. Consequently, she opted for laser therapy as an alternative, non-pharmacologic treatment modality.

Laser treatment was performed using a 1,726-nm sebum-selective laser (Aviclear[®], Cutera, Inc.) targeting lipid-rich sebaceous glands via selective photothermolysis. After gentle facial cleansing, no topical anesthetic was applied. The treatment parameters were standardized to a fluence of 19–20 J/cm² and a spot size of 10 mm. Two passes were applied



Figure 3 Microscopic findings from standardized skin surface biopsy ((A) ×40 magnification) and superficial needle scraping ((B) ×40 magnification with additional digital zoom for enhanced clarity) demonstrating the presence of *Demodex* mites.



Figure 4 Post-treatment clinical outcome at four weeks after the third laser session showing complete clearance of papulopustular lesions with marked reduction in background erythema and flushing.

to the cheeks, forehead, nose, and chin, for a total of 300 pulses per session. Throughout the procedure, dynamic contact cooling was utilized to protect the epidermis and enhance patient comfort.

The patient underwent three treatment sessions at four-week intervals. Each session achieved mild, transient erythema as the clinical endpoint, without blistering or epidermal disruption, and was well tolerated. Post-treatment care involved gentle cleansing, applying a bland moisturizer, and daily sunscreen application. No topical or systemic therapies were administered.

At baseline, the total inflammatory lesion count (ILC) was 234 papulopustular lesions involving the cheeks, forehead, and chin, accompanied by moderate erythema, flushing, telangiectasia, and prominent burning and stinging.

Two weeks after the initial treatment, the pustules had disappeared, and the inflamed papules were smaller and less red. However, the facial skin was notably dry and flaky, with itching.

By four weeks after the first treatment session, the ILC had decreased to 108 papular lesions. Additionally, *Demodex* density decreased to 50 mites/cm², along with improvements in symptoms, including reduced erythema, stinging, and burning.

Four weeks after the second treatment session, the ILC had 15 papular lesions remaining. Symptoms were significantly improved, with only mild skin dryness noted, and the density of *Demodex* mites further decreased to 35 mites/cm².

By four weeks after the third treatment session, complete clearance of the lesions was achieved. Background erythema and flushing were substantially reduced, and *Demodex* density had declined to 12 mites/cm² (Figure 4).

No adverse events were observed throughout the treatment period, and the patient reported high satisfaction with the outcomes.

Discussion

Papulopustular rosacea is increasingly conceptualized as a disorder of the pilosebaceous unit, driven by interactions among sebaceous gland activity, *Demodex* mite proliferation, and dysregulated innate immune responses. Accumulating evidence demonstrates that increased *Demodex* density correlates with inflammatory lesion burden, indicating a contributory or possibly causative role in disease development.^{3–7,11,22–24} In this context, the present case provides clinically and parasitologically concordant evidence that targeting sebaceous gland function may represent a rational therapeutic strategy. Treatment with a 1,726-nm sebum-selective laser resulted in marked clinical improvement, accompanied by a stepwise, quantitatively documented reduction in *Demodex* density.

The temporal association between decreasing *Demodex* density and progressive clinical improvement, including reductions in inflammatory lesions, burning, stinging, and flushing, suggests a mechanistic link between modulation of the follicular microenvironment and attenuation of disease activity. While causality cannot be definitively established in a single case, this concordance strengthens the biological plausibility of sebaceous gland-targeted intervention in papulopustular rosacea.

Sebaceous gland activity is central to maintaining the follicular niche required for *Demodex* survival, with sebum functioning as both a nutritional substrate and a pro-inflammatory mediator. *Demodex* mites can further amplify inflammation by modulating sebocyte function and activating Toll-like receptor pathways, thereby increasing cytokine production and sustaining immune activation.¹² A key pathogenic mechanism involves activation of Toll-like receptor 2 (TLR2) by increased mite density, triggering downstream cascades including abnormal cathelicidin (LL-37) processing, angiogenesis, and vascular hyperreactivity.^{4,25,26} In parallel, qualitative alterations in sebum composition may impair epidermal barrier integrity and contribute to heightened cutaneous sensitivity,²⁷ while sebaceous hyperplasia underlies structural changes observed in phymatous disease.²⁸ Collectively, these findings position the sebaceous unit as a central interface linking microbial, immunologic, and inflammatory pathways in rosacea.

Pharmacologic suppression of sebaceous gland activity with oral isotretinoin has demonstrated efficacy in refractory papulopustular rosacea and is associated with reductions in *Demodex* density, supporting the therapeutic relevance of targeting sebaceous function.^{14–19} However, its use is limited by systemic adverse effects, teratogenicity, and monitoring requirements. In contrast, the 1,726-nm sebum-selective laser offers a mechanism-based, non-systemic approach that selectively targets lipid-rich sebaceous glands via photothermolysis, inducing glandular atrophy and reducing sebum production while preserving surrounding tissue integrity.²⁹

The clinical effects observed in this case may be explained by several complementary mechanisms. First, reduction of sebum production likely disrupts the follicular microenvironment necessary for *Demodex* proliferation, thereby decreasing mite density. Second, suppression of sebaceous-derived inflammatory mediators may attenuate local immune activation. Third, normalization of sebum composition may contribute to the restoration of epidermal barrier function and a reduction in cutaneous sensitivity. Together, these effects suggest that sebaceous gland-targeted laser therapy may modulate multiple downstream pathways central to rosacea pathogenesis.

Further support for this approach comes from studies of acne vulgaris, in which sebaceous gland hyperactivity is a primary driver of pathogenesis. Previous studies have demonstrated that the 1,726-nm wavelength corresponds to a lipid absorption peak, enabling selective photothermal targeting of sebaceous glands and resulting in sustained reductions in sebum production and inflammatory lesion counts.^{20,21} These studies also demonstrate favorable safety profiles without the need for adjunctive systemic therapy. Although acne and papulopustular rosacea are distinct entities, their shared involvement of the pilosebaceous unit provides a mechanistic rationale for extrapolating sebaceous-targeted interventions across these conditions.

Notably, improvements in background erythema and flushing were observed despite the 1,726-nm wavelength not being optimized for vascular targeting. This finding suggests that attenuation of follicular inflammation and *Demodex*-associated immune activation may secondarily improve neurovascular dysregulation, consistent with contemporary models of rosacea pathophysiology.^{4,25,30} This indirect vascular benefit warrants further investigation, as it may expand the therapeutic implications of sebaceous-targeted approaches beyond purely inflammatory lesions.

The magnitude and temporal pattern of *Demodex* reduction in this case are comparable to those reported with acaricidal therapies, particularly topical ivermectin.³¹ However, in contrast to pharmacologic approaches, sebum-selective laser therapy is non-antimicrobial and may therefore mitigate concerns related to antimicrobial resistance, treatment adherence, and medication intolerance. This distinction is particularly relevant in patients with sensitive skin or those unwilling or unable to tolerate conventional therapies.

This report has several limitations. As a single-case observation, the findings are inherently limited in generalizability, and spontaneous disease fluctuation cannot be excluded. In addition, histopathologic confirmation of sebaceous gland changes was not performed, and the relative contribution of laser-induced sebaceous suppression versus other potential mechanisms cannot be definitively determined.

In conclusion, this case supports the concept that sebum-selective 1,726-nm laser therapy may represent a promising, mechanism-based, non-pharmacologic treatment option for papulopustular rosacea, particularly in patients with elevated *Demodex* density. These findings highlight the sebaceous gland as a therapeutic target in rosacea and suggest that modulation of the follicular microenvironment may have clinically meaningful effects. Further controlled studies are required to define efficacy, durability, optimal treatment parameters, and the role of this modality within combination treatment strategies.

Data Sharing Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

Statement of Ethics

The author states that the patient gave written informed consent for the case to be published (including publication of images). This research complies with all Ethical Guidelines for human studies in accordance with the World Medical Association Declaration of Helsinki. This paper is exempt from The Mae Fah Luang Ethics Committee on Human Research approval, with reference number COE 61/2026. Since it is a case report with no more than three cases, the information is derived from a review of medical records and cannot be linked to an individual unless written patient consent is obtained.

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Disclosure

The author declares no conflicts of interest in this work.

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