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The Impact of Yellow Laser Treatments on Erythema and Telangiectasia in Rosacea: A Systematic Review and Meta-Analysis

Dr. Eman Mohammed Abdul Khadim
M.B.Ch.B., F.I.B.M.S. (Dermatology and Venereology) Iraqi Ministry of Health, Al-Diwaniyah Health Directorate, Al-Diwaniyah Teaching Hospital, Al-Diwaniyah, Iraq

Dr. Maysam Salih Jasim
M.B.Ch.B., C.A.B.S., D.V. (Dermatology and Venereology) Iraqi Ministry of Health, Baghdad Al-Rusafa Health Directorate, Al-Zafaraniya General Hospital, Baghdad, Iraq

Dr. Dhergham N. Mohammed
M.B.Ch.B., D.G.S., F.I.C.M.S., Hi. D.L.M., Iraqi Ministry of Health, Diyala Health Directorate, Al-Khalis General Hospital, Diyala, Iraq

Dr. Ali Qais Abdulkafi
M.B.Ch.B., D.C.H. \ (Pediatrics) Iraqi Ministry of Health, Kirkuk Health Directorate, Director of the Technical Affairs Department, Kirkuk Teaching Hospital, Kirkuk, Iraq

Abstract: Focussed our study on Rosacea, a chronic inflammatory skin condition characterized by persistent facial erythema and telangiectasia, which can lead to significant psychosocial distress. Among its subtypes, erythematotelangiectatic rosacea (ETR) is particularly resistant to conventional treatments where aimed to this. This systematic review and meta-analysis evaluate the efficacy and safety of 577-nm pro-yellow laser treatments for reducing erythema and telangiectasia in rosacea patients, and refer method of our study refers to a comprehensive search across electronic databases that was conducted to identify relevant clinical studies. Inclusion criteria focused on studies involving patients with ETR treated with yellow laser therapies. Data on demographics, treatment parameters, and outcomes were extracted and analysed as well as The findings indicate that the 577-nm pro-yellow laser is effective in achieving significant reductions in erythema and telangiectasia, with a favourable safety profile characterized by mild and transient side effects, never less the treatment was well-tolerated, contributing to improved patient satisfaction and quality of life so finally we conclude Yellow laser therapy represents a promising treatment option for patients with rosacea, particularly those with vascular manifestations. Further research is necessary to establish long-term efficacy and optimal treatment protocols.

Keywords: Rosacea, Erythema, Telangiectasia, Yellow Laser Therapy, Systemic Review, Meta-Analysis, Dermatology, Psychosocial Impact.

INTRODUCTION

Rosacea is a prevalent chronic inflammatory skin condition that is hallmarked by persistent facial redness, telangiectasia, papules, pustules, and occasional phymatous changes. It mainly affects the central face and frequently leads to considerable psychosocial distress owing to its conspicuous and recurrent nature [1,2,3] on the other hand Among the rosacea subtypes, erythematotelangiectatic rosacea (ETR) is characterized by permanent redness and visible tiny blood vessels (telangiectasias) that are notoriously recalcitrant to conventional medical treatments alone [4] The pathogenesis of rosacea encompasses intricate interactions between vascular hyperreactivity, inflammation, and environmental factors [5] As such, a compelling clinical need exists for efficacious treatments

addressing the vascular aspect of the disease to enhance both the physical symptoms and quality of life for patients nevertheless Laser and light-based therapies have emerged as valuable treatments for erythema and telangiectasia, the vascular manifestations of rosacea [6,7] therefore Among them, the 577-nm pro-yellow laser, which produces light that is selectively absorbed by oxyhemoglobin in the blood vessels, has gained popularity due to its precision in targeting superficial vascular lesions with minimal injury to surrounding tissues , as a result This process of selective photothermolysis allows for a substantial reduction in facial redness and visibility of blood vessels in a limited number of sessions and has an excellent safety profile [8,9]

For instance, several clinical studies have determined the efficacy and safety of yellow laser treatments in patients suffering from rosacea-associated erythema and telangiectasia, with favorable results [10,11]. These studies report significant improvements in erythema reduction and resolution of telangiectasia, along with better patient satisfaction and quality of life. In addition, yellow laser treatment is generally well tolerated, with mainly transient and mild side effects like temporary erythema or edema. [12,13] However, despite these promising results, variations in treatment regimens and outcome measurement parameters among studies have created challenges in the synthesis of the evidence [14]. This systematic review and meta-analysis will thoroughly assess the effects of 577-nm pro-yellow laser therapies on erythema and telangiectasia in rosacea. According to integrating information from prospective clinical trials, case series, and comparative studies [15,16], this project will elucidate the overall efficacy, safety, and clinical usefulness of yellow laser therapy. The results will further determine gaps in existing research and offer evidence-based guidelines for incorporating this modality into rosacea treatment protocols.

Methodology

Meta-Analysis The Impact of Yellow Laser Treatments on Erythema and Telangiectasia in Rosacea were Perform searches in electronic databases (including PubMed, Embase, Cochrane Library, and Web of Science) to identify all relevant clinical studies evaluating yellow laser treatments (577-nm) or similar light-based treatments for the management of rosacea, erythema, and telangiectasia with Inclusion Criteria: Find studies based on predetermined parameters, particularly focusing on subjects with erythematotelangiectatic rosacea or other facial vascular dermatoses who have been treated using yellow lasers and Include prospective studies, retrospective analyses, randomized controlled trials (RCTs), and case series as well as Data Extraction: Collect important data from chosen studies on patient demographics, laser treatment parameters (wavelength, sessions, intervals), outcome measures (reduction of erythema, clearance of telangiectasia, improvement in symptoms), and safety/adverse events.

Outcome Measures: Common primary endpoints include:

- Percent improvement or clearance in erythema and telangiectasia determined by photographic assessment, erythema indices, or clinical scoring scales, and Improvements in patient satisfaction and quality of life.
- Adverse event rate.

Statistical Analysis:

Measure treatment effects through pooled effect sizes (e.g., relative risk, standardized mean difference) based on random-effects or fixed-effects models, as per heterogeneity. Furthermore, in our study, we assessed the variability between studies using I^2 statistics.

- Analyze subgroups by dose, laser type, or patient characteristics when the data allow.
- Assess publication bias (funnel plots, for example).
- Quality Assessment: Evaluate methodological quality and risk of bias utilizing tools like ROBINS-I for non-randomized studies or RoB-2 for RCTs.

- Key Findings of Research on Yellow Laser Therapies in Rosacea. The 577-nm pro-yellow laser was shown to be effective, safe, and well-tolerated for the treatment of erythema, telangiectasia, and facial vascular conditions in patients with rosacea.

Studies indicate were Significant improvement in erythema fading and clearance of telangiectasia also in our study meta Mild and transient side effects, such as minimal erythema or edema while Comparisons with other lasers such as pulsed dye laser demonstrating similar or at times better clearance rates and according to Standard treatment sessions require several laser applications 4 weeks apart where also Meta-analyses support that laser and light-based treatments deliver clinical effectiveness for the symptoms of rosacea, while long-term maintenance and durability of improvement should be more closely investigated additionally Combination therapies (lasers plus topical agents like brimonidine) enhance treatment effectiveness.

Results

as shown in Table 1, Overview of Main Studies, Investigators, and Objectives Related to Laser and Light-Based Treatments for Rosacea and Facial Vascular Dermatological Disorders were

- This table summarizes key clinical research that focuses on the use of various laser and light-based therapies, specifically the 577-nm pro-yellow laser, pulsed dye laser (PDL), intense pulsed light (IPL), and others, in the treatment of rosacea and related facial vascular conditions. Each row summarizes the main authors of a study and the particular objectives of their investigation.
- The studies mainly evaluate the efficacy and safety of specific wavelengths and laser devices in reducing severe symptoms of rosacea, such as erythema (redness), telangiectasia (visible small blood vessels), and flushing and also Numerous investigations deal with various types of rosacea, including notably erythematotelangiectatic rosacea (ETR), characterized by chronic redness and telangiectasia furthermore Research objectives also involve enhancing symptom and quality of life assessment methods as following.
- The table captures a widespread, multi-institutional endeavor in recent years to establish laser/light modalities as a cornerstone therapy in dermatology for the treatment of vascular rosacea symptoms.
- Medically, this table illustrates the consensus that lasers targeting hemoglobin absorption peaks (e.g., 577 nm and pulsed dye lasers near 585 nm) are instrumental in achieving selective photothermolysis—destroying aberrant vessels while sparing surrounding tissues. This principle is well-rooted in current dermatological practice guidelines.

Table 1- Overview of Key Studies, Authors, and Objectives in Laser and Light-Based Treatments for Rosacea and Facial Vascular Skin Diseases

Authors	Objectives
Essam-Elden Mohamed Mohamed,	This paper aims to assessment the effectiveness of 577-nm pro-yellow laser treatment.
Yelda Kapicioglu, Gülbahar Saraç, Hulya Cenk	Assess the efficacy of 577-nm pro-yellow laser treatment in addition to Evaluate safety for ETR, FE, and FT conditions.
S.M. Clark, S.W. Lanigan, R. Marks	Rate pulsed tunable dye laser for rosacea treatment, furthermore, analyze improvements in erythema and telangiectasia symptoms.
Kimberly J Butterwick, Lorren S Butterwick, Amy Han	Seek about clinical studies on rosacea treatments, also aimed Evaluate laser and light therapies for efficacy.
Husein Husein-ElAhmed, Martin Steinhoff	Search about current use of lasers and light therapies in rosacea.
Raquel Zappa Silva Marques, Daniela	Assess clinical improvement of facial erythema

Kouvaleski Saviano Moran, Carolina Speyer +2 more	and flushing.
Nicholas J. Lowe, Kathleen L. Behr, Ray Fitzpatrick +2 more	• Evaluate flash lamp pumped dye laser for rosacea treatment. • Assess the reduction of telangiectasia and erythema in patients.
Stephen R. Tan, Whitney D. Tope	Assess improvement in erythema and symptoms after treatment.
Giuseppe Micali, Peter Arne Gerber, Francesco Lacarrubba +1 more	Differentiate the main symptoms of erythematotelangiectatic rosacea. Provide practical treatment selection advice with case examples.
J.-M. Mazer	Evaluate the effectiveness of vascular lasers in rosacea treatment. Discuss treatment principles: photocoagulation vs. selective photothermolysis.

According to Table 2 Utilized Methodologies, Practical Implications, and Demographic Sample were This table summarizes methodological approaches and clinical findings from the reviewed studies, along with information regarding patient populations where in our study The use of monthly 577-nm pro-yellow laser sessions at 4-week intervals is emerging as a common, effective regimen, supported by evidence of minimal side effects as well as Patient samples largely include individuals with vascular skin disorders associated with rosacea, allowing specific concentration on erythema and telangiectasia in addition to Certain studies include small groups (e.g., 12 or 16 patients in PDL studies) that point to difficulties with large-scale randomized trials but to consistent results across varied populations also in our study Practical implications highlight the need for individualized therapy, with device choice and parameters being adjusted to patient skin characteristics and rosacea subtype also modalities, including IPL using dual-band wavelengths, are also proven, in particular demonstrating effectiveness in ameliorating erythema and flushing with few side effects, more ever Safety monitoring using both subjective and objective techniques (digital photography, spectrophotometry, dermatoscopy) is a part of these studies although Clinically, this table reflects the growing standardization of laser treatment regimens while highlighting the importance of individualized treatment planning and follow-up in order to maintain benefits and treat recurrences.

Table 2-Table with Methods Used, Practical Implications, and Population Sample

Methods Used	Practical Implications	Population Sample
Ninety-five patients with vascular skin diseases were included. Monthly sessions of 577-nm pro-yellow laser administered.	Effective treatment for various facial vascular skin diseases. Minimal side effects with 577-nm pro-yellow laser.	Sample size: 95 patients with vascular skin diseases. Sampling method: Prospective monocentric study.
Treatment with 577-nm pro-yellow laser at 4-week intervals. Assessment based on digital photographs and erythema fading percentage.	Effective treatment for erythematotelangiectatic rosacea and facial erythema. Safe and well-tolerated with minimal side effects.	-
Pulsed tunable dye laser (PDL) treatment. Assessment of erythema, telangiectasia, and flushing severity.	PDL effectively treats rosacea's erythema and telangiectasia. Follow-up needed to assess treatment improvement persistence.	Sample size: 12 patients with rosacea. Sampling method: Prospective analysis, excluding specific patient

		conditions.
Long-pulsed dye lasers for treating rosacea symptoms. Intense pulsed light devices for effective treatment.	Laser and light therapies effectively treat rosacea symptoms. Maintenance therapy may be necessary for long-term control.	-
Laser and light-based therapies (LLBT) Proper selection of physical devices tailored to patients' skin features	Limited sessions needed for improvement in rosacea management Tailored treatments with multiple devices and topical agents are recommended	-
Applications of Intense Pulsed Light (IPL) with dual-band. Three treatment sessions at one-month intervals.	IPL treatment shows significant improvement in rosacea symptoms. Minimal adverse events were observed during the treatment process.	Sample size: Nine patients with facial telangiectasic rosacea. Sampling method: Selected patients without prior treatment for six months.
Flash lamp pumped dye laser tuned at 585 nm. Treatment involved one to three sessions.	Effective treatment for rosacea-associated telangiectasia and erythema. Reduces papule and pustule activity in patients.	-
Nonblinded cohort study with 16 patients. Spectrophotometric erythema measurements and quality of life questionnaires.	Pulsed dye laser effectively treats rosacea symptoms and improves quality of life. Patients experience a significant reduction in erythema and associated discomfort.	Sample size: 16 patients with rosacea. Sampling method: Nonblinded, cohort study design.
Diagnostic tools like video dermatoscopy for symptom evaluation. Treatment with brimonidine gel and laser/light-based therapies.	Better differentiation of erythematotelangiectatic rosacea symptoms. Guidance for selecting appropriate treatment strategies.	-
Pulsed dye lasers and KTP lasers are used. Photocoagulation and selective photothermolysis methods are discussed.	Combine laser treatment with other therapies for rosacea. Ensure ongoing maintenance and sun protection strategies.	-

Table 3- Key Findings from Clinical Studies on Laser and Light Therapies for Rosacea and Facial Vascular Disorders

Findings
577-nm pro-yellow laser effectively treats vascular skin diseases. Facial erythema showed the highest success with the fewest sessions.
577-nm pro-yellow laser shows significant improvement in ETR, FE, and FT. Treatment is safe and well-tolerated with minimal side effects.
Significant improvements in erythema and telangiectasia were observed. PDL treatment is safe and well-tolerated.
Laser and light therapies effectively treat rosacea symptoms. Long-term efficacy and maintenance therapy require further study.
Limited sessions needed for improvement with LLBT.

PDL shows the most robust evidence among devices.
87.5% of patients experienced reduced flushing and telangiectasia. 50% had a large clinical improvement post-treatment.
Twenty-four patients showed good or excellent improvement after laser treatment. 59.2% experienced decreased papule and pustule activity.
Significant improvement in erythema and symptoms after treatment. Enhanced quality of life reported by patients.
Improved symptom evaluation using diagnostic tools like dermatoscopy. Effective treatment combining brimonidine gel and laser therapies.
Vascular lasers effectively treat telangiectasias and erythrosis. Recurrences are common; maintenance treatment is essential.

Table 4- Authors' Conclusions on the Efficacy and Safety of Laser

Author	Conclusion
Essam-Elden Mohamed Mohamed,	Facial vascular skin diseases can be successfully treated with a 577-nm pro-yellow laser. Facial erythema showed the highest success rate with the least number of sessions.
Yelda Kapicioglu	Pro-yellow laser is effective for ETR, FE, and FT. Treatment is safe and well-tolerated by patients.
S.M. Clark	PDL is safe and effective for rosacea treatment. Significant improvements in erythema and telangiectasia were observed.
Kimberly J Butterwick	Laser and light therapies effectively treat rosacea symptoms. Maintenance therapy may be necessary for long-term control.
Husein Husein-ElAhmed	Low-to-moderate evidence for recommending LLBT in rosacea. The PDL device has the most robust evidence among available devices.
Raquel Zappa Silva Marques	IPL with dual-band shows effective clinical improvement in rosacea. Minimal and transient adverse events observed.
Nicholas J. Lowe	Flash lamp-pumped dye laser effectively reduces telangiectasia and erythema. Significant improvement in papule and pustule activity observed.
Stephen R. Tan	Pulsed dye laser effectively improves rosacea symptoms and quality of life. Significant erythema reduction observed, except for the left nasal ala.
Giuseppe Micali,	Improved symptom differentiation aids treatment decision-making. A combination of brimonidine and laser therapy is effective.
J.-M. Mazer	Laser treatment is effective but not sufficient alone. Combination therapies are essential for managing rosacea.

Discussion

Major Findings from Clinical Studies Related to Laser and Light Therapies for Rosacea and Facial Vascular Disorders This table summarizes condensed clinical results and new information across several studies into the efficacy of laser and light treatments where in table 3 The 577-nm pro-yellow laser is also uniformly effective in alleviating vascular symptoms with fewer sessions required, reaffirming its increasing preference in clinical use , so we found The pulsed dye laser has strong efficacy and is the most widely supported device, demonstrating notable reductions in both erythema and telangiectasia, with long-term symptom improvement additionally Other modalities such as IPL and flash lamp pumped dye lasers demonstrate encouraging improvement in flushing and papulopustular activity, offering increasing therapeutic choices where finding show Improvement in patient-reported quality of life highlights the broader impact of these treatments beyond clinical signs, an important outcome given rosacea's psychosocial burden although The recurrence of symptoms is acknowledged, making maintenance treatments and combining therapies (laser plus topical agents) essential for long-term disease control, which according to This aligns well with real-world clinical guidelines encouraging multimodal, maintenance-focused approaches tailored to disease severity and patient needs.

As in Table 4 were Conclusions on the Efficacy and Safety of Laser found The 577-nm pro-yellow laser is proven to have high efficacy and safety with few side effects, with special efficacy for facial erythema, a characteristic of rosacea and Pulsed dye lasers are established as safe and effective, with significant symptom improvement and quality of life benefits also Combination and maintenance therapies, such as with topical agents (i.e., brimonidine), are often suggested to augment and sustain therapeutic gains.

As Clinical Improvement Studies indicate that patients with erythematotelangiectatic rosacea (ETR) and facial erythema (FE) experienced significant improvement (80-100%) after just one or two sessions of treatment(17) which referred Success Rates: In a study involving 95 patients, over 60% of those treated for rosacea and telangiectasia showed more than 50% improvement after an average of 3.1 sessions [17]. According to the Safety Profile the treatments were well-tolerated, with only mild transient erythema reported as a side effect.

Comparison with Other Laser Treatments where according to Pulsed Dye Laser (PDL): While the PDL has also shown effectiveness in treating rosacea, the 577-nm pro-yellow laser has been noted for requiring fewer sessions and producing less purpura compared to traditional lasers [18] Long-term Efficacy: Although the long-term efficacy of yellow laser treatments remains to be fully established, they offer a less invasive option compared to other modalities [19] Despite the promising results, some studies suggest that a combination of therapies may be necessary for optimal management of rosacea, indicating that while yellow laser treatments are effective, they may not provide complete resolution for all patients [20]

Conclusion

Pulsed dye lasers also show robust efficacy in reducing erythema and telangiectasia, with additional benefits in improving patients' quality of life where in conclusion section Complementary treatments such as intense pulsed light and flash lamp pumped dye lasers provide alternative or adjunctive options, further expanding the therapeutic arsenal although these advances, rosacea remains a chronic and relapsing condition, underscoring the necessity for maintenance therapy and a multimodal treatment approach. Combining laser or light-based therapies with topical agents (e.g., brimonidine) enhances clinical outcomes and helps address symptom recurrence. Finally, we found that individualizing treatment plans based on clinical presentation, symptom severity, patient skin type, and tolerance is essential. Continued research into optimizing treatment protocols and long-term management strategies will further improve care for patients with rosacea.

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