Review

Clinical Application of Intense Pulsed Light: An Update and Critical Review

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Abstract: **Background:** Intense pulsed light (IPL) has evolved from a vascular and pigmentary device into a versatile platform used across medical dermatology, aesthetic dermatology, scar management and ocular surface disease. Recent publications have expanded its recognized utility in rosacea, meibomian gland dysfunction, melasma, post-inflammatory dyschromia, hair reduction, scar modulation, and multimodal rejuvenation. At the same time, contemporary literature has highlighted unresolved issues regarding patient selection, parameter customization, durability of response, and long-term safety. **Methods:** A comprehensive literature review was conducted covering publications from 2024 to 2026 on the clinical application of IPL. The source framework was based on MEDLINE, PubMed, and Ovid database retrieval. These include randomized controlled trials, comparative studies, retrospective analyses, systematic reviews, meta-analyses, case series, case reports, translational studies, and narrative reviews. All included studies were classified according to the Oxford Centre for Evidence-Based Medicine 2009 Levels of Evidence. **Results:** The most mature recent evidence supports IPL for erythematotelangiectatic rosacea and meibomian gland dysfunction-related ocular surface disease, where randomized trials, systematic reviews, and meta-analyses generally show improvement in erythema, telangiectasia, tear film stability, meibomian gland function, and symptom burden. Emerging data also support broader roles in facial rejuvenation, melasma, sensitive skin, hypertrophic scars, keloids, post-inflammatory hyperpigmentation, chalazion, and selected reconstructive or hair-reduction indications. Combination strategies appear particularly promising, including IPL with mesotherapy, topical tranexamic acid, collagen dressings, postoperative radiotherapy, microneedling, fractional carbon dioxide laser, corticosteroids, and gland-directed ocular interventions. However, heterogeneity remains substantial across device platforms, filters, pulse structures, treatment intervals, concomitant therapies, comparator groups, and outcome measures. Several studies are retrospective, small, or indication-specific, and some fields remain supported mainly by case-based or narrative evidence. **Conclusions:** Contemporary evidence positions IPL as a genuinely multipurpose therapeutic platform rather than a single-indication device. Its strongest present applications lie in vascular rosacea, ocular surface disease associated with meibomian gland dysfunction, and selected rejuvenation protocols. Broader indications are increasingly plausible, but many still require standardized protocols, longer follow-up, and higher-quality comparative trials before firm clinical algorithms can be established.

Keywords: intense pulsed light therapy; rosacea; meibomian gland dysfunction; dry eye syndromes; hyperpigmentation; cicatrix

1. Introduction

Intense pulsed light has become one of the most adaptable light-based technologies in contemporary practice [1]. Unlike single-wavelength lasers, IPL delivers noncoherent, polychromatic light through selectable filters and adjustable pulse structures, allowing one device family to target superficial vasculature, pigmentation, inflammation, and texture-related change in different clinical contexts [2]. This flexibility explains why IPL now occupies an unusual position at the intersection of medical dermatology, aesthetic rejuvenation, scar modulation, photoepilation, and ophthalmic periocular therapy. Yet the same flexibility that makes IPL attractive also complicates interpretation of the literature, because wavelength bands, fluence, pulse duration, cooling, repetition schedules, and adjunctive treatments vary considerably across studies [3].

Previous rosacea treated by intense pulsed light literatures illustrate this duality especially well [4–6]. They conclude that IPL is generally effective for erythema and telangiectasia, with transient and usually tolerable adverse effects, while comparative evidence suggests broadly similar erythema reduction to pulsed dye laser in many settings and possibly a slight advantage for high-grade clearance in some analyses [7].

A parallel expansion has occurred in ophthalmology. IPL has moved beyond its dermatologic origins and is now widely studied for meibomian gland dysfunction, dry eye disease, ocular rosacea, blepharitis, Demodex-associated disease, and chalazion [8,9]. The ophthalmic literature is clinically important because it highlights an anti-inflammatory and gland-modulating role for IPL that is not fully captured by the classic paradigm of selective photothermolysis alone [10].

Beyond vascular and ocular indications, IPL is increasingly being positioned as a platform for combination therapy [11]. Recent studies evaluate its integration with fractional carbon dioxide laser [12], tranexamic acid [13], intralesional corticosteroids [14], botulinum toxin [15] and postoperative radiotherapy [16]. These multimodal strategies reflect the reality that many contemporary treatment targets, such as melasma, post-inflammatory dyspigmentation, hypertrophic scarring, facial inflammation, and photoaging, are biologically mixed disorders involving vascular, inflammatory, pigmentary, and matrix-remodeling components. IPL's broad spectral profile may therefore be most valuable not when viewed as a stand-alone device, but when used as one component of a phenotype-directed procedural program [17].

The purpose of this review is to provide an updated and critical synthesis of the clinical application of IPL. Particular attention is given to the strength of evidence across indications, the growing role of combination therapy, the emergence of objective imaging and translational mechanistic work, and the practical limitations that currently prevent full standardization of IPL-based treatment pathways.

2. Methods

A comprehensive literature review was conducted covering publications from 2024 to 2026 on the clinical application of IPL. The source framework was based on MEDLINE, PubMed, and Ovid database retrieval. These include randomized controlled trials, comparative studies, retrospective analyses, systematic reviews, meta-analyses, case series, case reports, translational studies, and narrative reviews. Each article was examined for indication, study design, sample characteristics, comparator use, intervention protocol, endpoints, major efficacy findings, safety observations, and key methodological limitations. Each article evidence levels were assigned according to the Oxford Centre for Evidence-Based Medicine 2009 framework [18].

3. Results

Cai et al. [19] performed a retrospective study of 48 patients with 66 post-traumatic hyperpigmentation lesions and compared IPL plus fractional CO_2 laser with IPL alone, CO_2 alone, and observation. Combination therapy achieved the highest rate of marked improvement, with 95.2% of lesions reaching strong GAIS benefit and no recurrence or serious complications reported. The study is clinically useful because it suggests synergy between pigment-targeting and remodeling-oriented energy delivery, although the retrospective design and lesion-level rather than patient-level analysis limit definitive inference (Level 2b).

Fan et al. [20] reported a real-world retrospective analysis of 236 patients who underwent at least six IPL sessions for acne-related erythema, rosacea, or cosmetic rejuvenation. Objective VISIA measures showed significant improvement in erythema, pigmentation, and wrinkles, while regular treatment intervals and a higher cumulative number of sessions predicted better outcomes. Fitzpatrick type IV skin showed lower response rates. This study is important because it frames IPL as a longitudinal skin-quality intervention rather than a single-course procedure, but its uncontrolled design prevents separation of natural fluctuation from treatment effect (Level 2b).

Chen et al. [21] retrospectively compared pulsed dye laser, IPL, and multisource radiofrequency in 120 patients with erythematotelangiectatic rosacea. All three modalities improved clinician erythema scores, patient self-assessment, and rosacea quality-of-life measures. Reported efficacy rates were 57.5% for PDL, 45.0% for IPL, and 67.5% for radiofrequency, but between-group differences were not statistically significant. The principal message is not superiority of one device, but that nonvascular energy platforms may compete meaningfully with vascular devices in selected rosacea patients. Retrospective allocation and nonstandardized treatment intensity remain the major weaknesses (Level 2b).

Shen et al. [22] evaluated IPL combined with collagen wound dressings for facial postburn hyperpigmentation. Based on the accessible abstract record, the combination approach outperformed dressing-based care alone and was reported to be safe, with minimal side effects. The study is relevant because postburn dyschromia is difficult to treat and often coexists with barrier impairment, making a regenerative dressing adjunct biologically plausible. However, publicly available details on exact patient numbers, endpoint structure, and longer-term relapse remain limited, so interpretation should remain cautious (Level 2b).

Qiu et al. [23] retrospectively studied 84 patients with facial photoaging treated with IPL plus mesotherapy containing non-crosslinked sodium hyaluronate, tranexamic acid, and vitamin C. VISIA parameters and wrinkle scores improved

significantly, with peak benefit observed shortly after treatment and mild nonsignificant rebound later. Satisfaction exceeded 80%, and adverse effects were mild and transient. The study supports multimodal rejuvenation in which IPL addresses vascular and pigmentary features while mesotherapy targets hydration and dermal quality, but the absence of a mesotherapy-free comparator limits attribution of effect (Level 2b).

Feng et al. [24] performed a 28-day split-face study in 32 women to examine a fibronectin-based skincare regimen after IPL. Compared with the control side, the fibronectin-treated side showed better hydration, lower transepidermal water loss, reduced erythema, and improved radiance without adverse events. This work is valuable because it addresses an often-neglected aspect of IPL practice, namely post-procedural barrier recovery and patient comfort. Nonetheless, the sample was small, follow-up was short, and the study focused on supportive care rather than the independent efficacy of IPL itself (Level 2b).

Malkoff et al. [25] described four hidradenitis suppurativa cases treated with ablative fractional CO_2 laser-assisted triamcinolone delivery, with or without adjunctive IPL. Patients receiving the combined approach showed numerically greater improvement in scar and quality-of-life measures than those treated without IPL, and no adverse effects were reported. The paper is best interpreted as an exploratory proof-of-concept suggesting that IPL may enhance multimodal scar and inflammation control in hidradenitis, but the cohort is too small and heterogeneous to establish protocol superiority (Level 4).

Jo et al. [26] presented a case series of four pilonidal disease patients who transitioned from clinic-based epilation to home IPL devices after surgery. Over follow-up of 1 to 3 years, no patient reported device-related injury or recurrence. The practical significance of the article lies in its emphasis on treatment accessibility and long-term maintenance outside tertiary centers. However, because it is an informal case series without objective hair counts or a comparison group, the findings support feasibility more than efficacy quantification (Level 4).

Tang et al. [27] conducted a randomized controlled trial in 60 patients with meibomian gland dysfunction, comparing IPL alone with IPL plus deep eyelid margin cleaning. Combined treatment resulted in better symptom reduction, improved tear film stability, and superior lower-eyelid gland outcomes. This study is clinically important because it suggests that mechanical relief of gland orifice obstruction may potentiate the thermal and anti-inflammatory effects of IPL. The trial was single-center and investigator-masked rather than fully double-blind, but it still represents one of the stronger contemporary ophthalmic IPL studies (Level 1b).

Di Guardo et al. [28] retrospectively evaluated rhodamine-based IPL in 12 patients with hypertrophic scars showing a prominent vascular component. Clinical, photographic, and dynamic optical coherence tomography analyses all suggested reduced erythema, vessel diameter, and vessel density, while patient satisfaction improved and adverse events were mild. The work is notable for pairing clinical observation with instrumental vascular imaging, thereby strengthening mechanistic credibility. Its chief limitations are the very small cohort and lack of comparison with steroid, silicone, or laser-based scar standards (Level 2b).

Gotoda et al. [29] examined age-related differences in IPL response among women with meibomian gland dysfunction. Available bibliographic data indicate that tear film stability and subjective symptoms improved across age groups, while younger patients appeared to show greater gains in some parameters. This is clinically relevant because it suggests that the biology of gland dysfunction and periocular tissue response may influence outcomes. However, as the accessible evidence is limited largely to abstract-level information, the study currently contributes supportive but not definitive age-stratified guidance (Level 2b).

Acar et al. [30] reviewed the role of IPL in melasma and concluded that IPL has utility for epidermal, dermal, and vascular components, especially in combination regimens, but that monotherapy evidence remains modest and protocol heterogeneity is substantial. This review is useful because melasma is often discussed primarily in relation to Q-switched lasers and topical agents, whereas IPL occupies a more ambiguous niche. Still, as a narrative review rather than a comparative clinical study, it is better viewed as a conceptual update than practice-changing evidence (Level 5).

Tichenor et al. [31] published a paper on IPL and radiofrequency for ocular surface disease. Rather than testing efficacy in a new patient cohort, the article standardizes practical treatment workflow and summarizes the mechanistic rationale for using IPL to reduce periocular inflammation and radiofrequency to liquefy meibum and improve tissue tone. Its importance lies in protocol dissemination and clinical reproducibility. However, because it is essentially a technique paper without comparative outcomes, it does not independently strengthen the efficacy evidence base (Level 5).

Peira et al. [32] conducted a systematic review and meta-analysis of 13 randomized studies of IPL for dry eye symptoms due to meibomian gland dysfunction. IPL probably produced a clinically meaningful symptom reduction compared with placebo, but benefit as an add-on to standard care was less certain and adverse-event evidence remained very uncertain. This meta-analysis is valuable because it distinguishes idealized placebo-controlled benefit from the more clinically relevant question of incremental benefit over usual care. Its conclusions are tempered by moderate risk of bias and incomplete safety reporting (Level 1a).

Tang et al. [33] retrospectively compared PDL, narrow-band IPL, and broad-band IPL in 112 patients with erythematotelangiectatic rosacea. Narrow-band IPL was strongest for erythema and porphyrin reduction, broad-band IPL reduced

sebum most but caused more pigmentation change, and PDL offered a favorable balance of efficacy and tolerability. The study is clinically relevant because it shows that the term "IPL" conceals materially different treatment behaviors depending on wavelength selection. Its retrospective design and absence of randomization, however, leave room for selection effects (Level 2b).

Tian et al. [34] used an LL-37-induced rosacea-like mouse model to investigate a novel microsecond-pulse IPL platform. The device improved erythema, reduced neutrophils, mast cells, and CD31-positive vessels, and appeared to improve barrier permeability, especially with dual-band filtering. This preclinical work is important because it supports the idea that IPL may act through inflammatory and barrier-restoring pathways in addition to vessel targeting. Nevertheless, translation from murine skin to human treatment algorithms remains indirect (Level 5).

Lai et al. [35] evaluated IPL for dry eye after SMILE surgery and reported better long-term symptom and tear-film outcomes than conventional medication, even after weighting methods were used to reduce selection bias. Diabetes adversely affected outcomes and adverse-event risk, whereas IPL reduced both symptom burden and measured dysfunction. The study is notable because it extends IPL into a postoperative ocular surface population rather than idiopathic MGD alone. Still, it remains observational and therefore cannot fully exclude confounding by baseline disease severity or co-interventions (Level 2b).

Wang et al. [36] combined an in vivo guinea pig model with a small clinical melasma cohort to evaluate AOPT-LTL IPL. The authors reported reductions in pigmentation, erythema, inflammatory mediators, angiogenic signals, mast cell infiltration, and SCF/c-KIT pathway activity, while patients also experienced lower mMASI and erythema index scores. This translational design is appealing because it connects visible clinical improvement with plausible biological mechanisms. However, the clinical arm was small and uncontrolled, so the study is more mechanistically suggestive than confirmatory (Level 4).

Chen et al. [37] performed a systematic review and network meta-analysis comparing IPL and LipiFlow for meibomian gland dysfunction using indirect evidence from 12 randomized trials. Both modalities improved outcomes versus controls, but IPL showed stronger effects for tear breakup time and SPEED score, whereas LipiFlow improved TBUT and OSDI. Because no head-to-head studies existed, the authors appropriately warned against overinterpreting indirect superiority. This paper is useful for comparative framing, but its certainty is constrained by heterogeneous control groups and the lack of direct randomization between devices (Level 1a).

Li et al. [38] conducted a bibliometric and visualized analysis of IPL research for dry eye disease from year 2015 to 2024. Publications increased markedly over the decade, with growing international collaboration and concentration in ophthalmology and photomedicine journals. The paper does not test clinical efficacy, but it does demonstrate that ocular IPL has shifted from a niche topic to a rapidly expanding research field. As with all bibliometric work, its main limitation is that publication volume and citation structure do not necessarily equal therapeutic validity (Level 5).

Teerawatanapong et al. [39] performed a randomized, single-blind, split-area trial of home-use IPL for keratosis pilaris. Weekly treatment improved skin roughness compared with sham irradiation, while erythema and hyperpigmentation differences were not significant and no severe adverse events occurred. This study matters because it tests a home device in a controlled way rather than relying on anecdote. Still, only 10 participants completed the study, so the findings mainly support proof of concept and convenience rather than robust generalizability (Level 1b).

Lipka-Trawińska et al. [40] studied 38 subjects with facial vascular lesions and used cross-polarized photography plus GLCM and QTDCOMP image analysis to quantify response after three IPL treatments. Significant reductions in vascular lesion metrics and improved skin homogeneity were documented. The study's real contribution is methodological: it shows how objective imaging may reduce dependence on subjective erythema scoring in future IPL trials. The absence of a control group, however, means it primarily validates assessment tools alongside treatment experience rather than proving comparative efficacy (Level 2b).

Liu et al. [41] performed a systematic review and meta-analysis of IPL for ocular demodicosis. Across six trials involving 329 adults, IPL improved Demodex eradication rates and showed a trend toward lowering mite counts, with no major adverse events reported. This is clinically relevant because Demodex infestation is increasingly recognized in refractory blepharitis and ocular rosacea. Nevertheless, certainty was low, and the reduction in mite counts did not consistently reach statistical significance, so the study supports cautious optimism rather than protocol standardization (Level 1a).

Chikhalkar et al. [42] investigated IPL in vascular mode for topical steroid damaged or steroid-dependent face. In a small 6-month clinical study, three sessions of 590-nm IPL were associated with significant improvement in erythema and burning symptoms. This indication is important because steroid-damaged facies shares vascular instability and sensitivity features with rosacea but is clinically more fragile. The main problem is evidentiary strength: the cohort was small, apparently uncontrolled, and best regarded as a stimulus for larger trials rather than a definitive treatment recommendation (Level 4).

Chan et al. [43] synthesized 12 studies on combined low-level light therapy and IPL for meibomian gland dysfunction. Pooled data showed improvement in OSDI, tear breakup time, and Schirmer testing, with some evidence of short-term

structural benefit in meibomian gland area. This review suggests that IPL may work especially well when integrated with other light-based or photobiomodulatory modalities. However, heterogeneity was extremely high for several endpoints, and the durability of gland-structure improvement was uncertain, limiting the firmness of long-term conclusions (Level 1a).

Hwang et al. [44] studied the effects of IPL wavelength and intensity on microbial inactivation. Although not a patient-based clinical article, the study is conceptually relevant because it offers a possible mechanistic rationale for why IPL might benefit acneiform, blepharitic, or biofilm-associated disorders beyond vascular photothermolysis alone. Its limitation is obvious: antimicrobial effects in experimental systems do not directly establish bedside efficacy, and translation to skin or ocular microbiology must be cautious (Level 5).

Fu et al. [45] retrospectively analyzed 181 patients with sensitive skin treated with low-energy delicate pulsed light. Significant improvement was observed in symptom scores, clinician erythema ratings, and VISIA-based redness values, with no obvious adverse effects. The study is interesting because it supports the idea that lower-energy IPL variants may calm rather than provoke reactive skin. Yet the cohort mixed several underlying diagnoses, including rosacea, acne, and dermatitis, so indication-specific conclusions remain limited (Level 2b).

Zhang et al. [46] retrospectively examined 90 rosacea patients treated with hydroxychloroquine plus topical repair therapy alone or with added IPL or LED. Both light-based groups outperformed medication alone, with effective rates of 73.3% for the IPL combination and 66.7% for the LED combination versus 40% in controls. The paper supports multimodal anti-inflammatory care and suggests IPL can augment systemic therapy. However, mixed rosacea features, retrospective grouping, and physician-rated outcomes make the magnitude of the independent IPL effect difficult to isolate (Level 2b).

Kochergin et al. [47] discussed the potential of IPL in the post-acne symptom complex, particularly residual pigmentation, texture irregularity, and erythematous change. Available bibliographic information suggests the paper functions mainly as a practical review rather than a controlled clinical study. Its inclusion is still useful because post-inflammatory sequelae after acne often share pathobiologic overlap with other dyschromic and vascular states in which IPL is already used. The limitation is that the article adds conceptual breadth more than high-grade comparative evidence (Level 5).

Wang et al. [48] reported a case of macular hole after accidental ocular exposure to IPL without eye protection. Although surgery achieved anatomical closure, visual recovery remained poor because of persistent photoreceptor and retinal pigment epithelium damage. This case is highly important from a safety perspective because it reminds clinicians that IPL is not inherently benign when misused near the eye. The article does not challenge the therapeutic role of IPL, but it strongly reinforces the need for strict ocular shielding and operator vigilance (Level 4).

Tang et al. [49] performed a prospective randomized study of sequential triple therapy consisting of microneedling, hydrolifting, and IPL for facial inflammation. The triple-therapy group achieved better inflammatory area reduction and GAIS scores than hydrolifting alone or IPL monotherapy, with no significant increase in adverse events. This study is important because it exemplifies the current shift from single-device thinking toward pathway-based combination care. However, the enrolled population was clinically broad, and the term “facial inflammation” includes multiple etiologies, which limits disease-specific interpretation (Level 1b).

Guo et al. [50] described the clinical application of IPL depilation in autologous reconstructed auricles created with tissue-expander procedures. Available bibliographic information indicates that IPL-assisted hair removal was considered safe and effective in this reconstructive setting, helping address an important cosmetic problem after auricular reconstruction. The study expands IPL’s role into staged reconstructive management rather than conventional aesthetic practice. Because publicly accessible details are limited and the report appears largely experience-based, it currently serves as supportive technical evidence rather than a standardized depilation protocol (Level 4).

Liu et al. [51] randomized 56 patients with facial erythema associated with acne vulgaris or rosacea to IPL alone or IPL plus topical 3% tranexamic acid. Combination therapy produced superior overall efficacy, a greater reduction in erythema, and better quality-of-life scores, without serious adverse effects. This trial supports the increasingly plausible view that tranexamic acid may act as a useful anti-inflammatory and anti-vascular adjunct to device therapy. Its major limitation is that rosacea-specific and acne-specific responses were pooled rather than analyzed separately (Level 1b).

Weng et al. [52] conducted a prospective randomized trial in 52 men with chest keloids treated with postoperative radiotherapy alone or radiotherapy plus IPL. The combination group showed better VSS and POSAS outcomes, along with less pain and itch, though thickness differences were less impressive. This work is clinically relevant because it places IPL within a postoperative scar-prevention framework rather than late salvage treatment. The restriction to a specific demographic and anatomic site, however, means the findings should be generalized cautiously (Level 1b).

Chen et al. [53] reviewed IPL for ocular surface diseases and concluded that it has established value in meibomian gland dysfunction while showing promise in blepharitis, recurrent chalazia, and other dry eye-related conditions. The article is a useful narrative synthesis because it places ophthalmic IPL within a mechanistic framework involving meibum modulation, vascular change, and inflammatory control. As a review without pooled quantitative analysis, however, it is best used as a clinical overview rather than definitive evidence (Level 5).

Lin et al. [54] revisited neglected safety concerns associated with IPL and highlighted biomarker-level signals of oxidative stress, senescence, inflammatory activation, and possible photoaging or photocarcinogenic concern if treatment

is performed improperly. This review is important because it complicates the common assumption that nonlaser automatically means low-risk. Still, the authors themselves acknowledge that the clinical significance of many biomarker changes remains uncertain, so the review should inform cautious parameter selection rather than provoke indiscriminate alarm (Level 5).

Leal-Silva et al. [55] reviewed IPL hair removal and summarized its history, mechanism, patient selection, and clinical utility. Although hair removal is one of IPL's oldest indications, the paper is relevant to a clinical applications review because photoepilation remains one of the most evidence-grounded uses of the technology and informs reconstructive and home-device expansions seen in later articles. The review contributes breadth rather than novel outcome data and therefore occupies a background-supporting rather than practice-changing role (Level 5).

Ruan et al. [56] randomized 60 patients with erythematotelangiectatic rosacea to PDL, DPL, M22 590, or M22 vascular-filter IPL. All groups improved in symptoms, VISIA red area, and rosacea quality-of-life, and no clear efficacy differences emerged, although the vascular-filter IPL arm produced more blistering. The trial is important because it argues that several modern vascular-light platforms may work comparably when used well. At the same time, it reinforces that safety profiles can diverge even when efficacy appears similar (Level 1b).

Piccolo et al. [57] prospectively evaluated a vascular chromophore-specific IPL system in 39 patients with facial vascular lesions, including rosacea-associated lesions. Most patients achieved good or excellent improvement, and relevant adverse effects were absent. The study is clinically appealing because it suggests that selective filtering within the broader IPL spectrum can produce rapid and meaningful vascular benefit. Nevertheless, the population included several vascular lesion types rather than rosacea alone, so disease-specific extrapolation is somewhat diluted (Level 2b).

Jiang et al. [58] randomized 149 children with chalazia to IPL or hot compress therapy. IPL yielded higher cure and efficacy rates, especially for granulomatous chalazia, and no adverse reactions were noted. This study is notable because it broadens the recognized clinical territory of IPL into pediatric lid disease. Still, some outcomes relied on clinically categorized chalazion subtypes and subjective assessment, and the authors themselves acknowledged the need for larger multicenter validation (Level 1b).

Lee et al. [59] shared practical clinical experience using IPL safely for several forms of post-inflammatory hyperpigmentation. The article emphasizes consultation, patch testing, individualized parameters, aftercare, and long treatment courses, illustrated through case-based resolution of PIH from burns and previous device injury. Its value lies in practical nuance: successful IPL use in dyschromia often depends less on a single session and more on cumulative, carefully titrated treatment. Because the paper is essentially a technical case-sharing review, its evidentiary strength remains limited (Level 4).

Wang et al. [60] performed a systematic review and meta-analysis of laser or IPL treatment for early surgical scars. Across 12 prospective randomized studies, active treatment improved Vancouver Scar Scale outcomes with minimal serious adverse events. This review matters because it places IPL within the broader scar-modulation literature rather than treating it as a niche adjunct. However, the pooled analysis did not isolate IPL-specific outcomes from all laser modalities, so the conclusions support energy-based early scar intervention more strongly than they define the precise contribution of IPL itself (Level 1a).

Martignago et al. [61] systematically reviewed IPL in rosacea and found that most included studies showed meaningful improvement in telangiectasia and erythema, with generally transient adverse effects. The authors also stressed that methodological quality was poor and protocols were heterogeneous. This review is important because it provides a cautious counterbalance to enthusiastic case-based reporting and makes clear that rosacea remains one of IPL's best indications, while simultaneously showing how far the field still is from fully standardized high-certainty evidence (Level 1a).

Chan et al. [62] reported treatment of hypertrophic scar, post-inflammatory hyperpigmentation, and post-inflammatory hypopigmentation with IPL. Although no abstract is available in PubMed, the article appears to describe case-based success in a complex mixed dyspigmentation and scarring scenario. Its practical importance is that such mixed presentations are common in real clinics and often poorly suited to single-target devices. Because the evidence is case-based and quantitative outcome data are limited in the accessible record, the paper should be read as illustrative rather than definitive (Level 4).

Dobroshi et al. [63] retrospectively studied 20 patients treated with a narrowband IPL module for pigmented lesions. Blinded GAIS and patient satisfaction scores were favorable, and adverse events were minimal. The paper is useful because it reinforces that newer IPL modules continue to compete with pigment-focused laser platforms for benign pigmented conditions, with the added attraction of broader skin-quality effects. However, the study lacked a comparator arm and included a small cohort, so its place is supportive rather than decisive (Level 2b).

Zhai et al. [64] performed a meta-analysis comparing IPL and pulsed dye laser for rosacea. The authors found no significant difference in achieving greater than 50% clearance or in erythema index change, but IPL showed a slight advantage for more substantial clearance above 75%, while PDL appeared less painful. This meta-analysis is highly relevant because it captures the central contemporary rosacea question of device selection rather than device versus no treatment. Its limitation is the very small number of directly comparative studies (Level 1a).

Wang et al. [65] described seven cases of noninfectious granulomas after mesotherapy treated with IPL plus low-dose intralesional corticosteroids. Physicians reported marked clinical improvement, patients were largely very satisfied, and no recurrences or adverse reactions were observed during follow-up. This case series suggests that IPL may help manage chronic inflammatory or granulomatous sequelae after cosmetic procedures, especially when vascular and inflammatory pathways coexist. The absence of controls, however, means the additive value of IPL over steroid therapy alone remains uncertain (Level 4).

Clague et al. [66] presented four cases using hyperdiluted botulinum toxin, alone or alternating with IPL, for hypertrophic scar reduction. Improvements were described in scar size, overall appearance, and erythema over six months. The novelty of the article lies in its protocol logic: botulinum toxin may reduce tension-related scar activity, while IPL addresses vascular redness and overall surface quality. The concept is intriguing and clinically creative, but it remains preliminary and requires controlled testing before it can be integrated into routine scar algorithms (Level 4).

Shergill et al. [67] performed a scoping review of IPL in ocular rosacea and found that most patients experienced partial response with limited adverse events, though complete recovery was not reported. This paper is helpful because ocular rosacea sits at the interface of dermatology and ophthalmology, and it reminds clinicians that periocular dryness may improve meaningfully even when cutaneous rosacea is not the dominant complaint. The literature base was small, so the review supports promise rather than established protocol uniformity (Level 5) (Table 1).

Table 1. Summary of Recent Literature on the Clinical Application of Intense Pulsed Light.

Author/Year	Study Design	Key Findings	Evidence Level
Cai et al., 2026 [19]	Retrospective study	IPL combined with fractional CO_2 laser achieved the highest rate of marked improvement in post-traumatic hyperpigmentation compared with IPL alone, CO_2 alone, and observation; no recurrence or serious complications were reported.	2b
Fan et al., 2026 [20]	Real-world retrospective study	Long-term regular IPL improved erythema, pigmentation, and wrinkles. Better outcomes were associated with regular treatment intervals and a higher cumulative number of sessions, whereas Fitzpatrick type IV skin showed lower response rates.	2b
Chen et al., 2026 [21]	Retrospective comparative study	Pulsed dye laser, IPL, and multisource radiofrequency all improved erythematotelangiectatic rosacea, with no statistically significant between-group difference.	2b
Shen et al., 2026 [22]	Clinical study	IPL combined with collagen wound dressings appeared more effective than dressing-based care alone for facial postburn hyperpigmentation and was reported to be safe.	2b
Qiu et al., 2026 [23]	Retrospective study	IPL plus mesotherapy with non-crosslinked sodium hyaluronate, tranexamic acid, and vitamin C improved facial photoaging parameters, wrinkle scores, and patient satisfaction, with mild transient adverse effects.	2b
Feng et al., 2026 [24]	Split-face study	A fibronectin-based skincare regimen after IPL improved hydration, transepidermal water loss, erythema, and radiance compared with the control side, without adverse events.	2b
Malkoff et al., 2026 [25]	Case series	Combination ablative fractional CO_2 laser-assisted triamcinolone, with or without adjunctive IPL, suggested numerically greater improvement when IPL was included in hidradenitis suppurativa management.	4
Jo et al., 2026 [26]	Case series	Home IPL devices were feasible for reducing postoperative hair burden in pilonidal disease, with no reported recurrence or device-related injury during follow-up.	4
Tang et al., 2026 [27]	Randomized controlled trial	IPL combined with deep eyelid margin cleaning resulted in better symptom reduction, improved tear film stability, and superior lower-eyelid gland outcomes than IPL alone in meibomian gland dysfunction.	1b
Di Guardo et al., 2026 [28]	Retrospective study	Rhodamine IPL improved erythema, vessel diameter, and vessel density in hypertrophic scars, supported by dynamic optical coherence tomography findings.	2b

Table 1. *Cont.*

Author/Year	Study Design	Key Findings	Evidence Level
Gotoda et al., 2026 [29]	Observational study	IPL improved symptoms and tear-film parameters in women with meibomian gland dysfunction across age groups, with some outcomes appearing better in younger patients.	2b
Acar et al., 2026 [30]	Narrative review	IPL may have utility in melasma, especially in combination regimens, but monotherapy evidence remains limited and protocol heterogeneity is substantial.	5
Tichenor et al., 2025 [31]	Technique paper	Standardized a practical workflow for IPL and radiofrequency in ocular surface disease and summarized mechanistic rationale, but did not contribute comparative efficacy data.	5
Peira et al., 2025 [32]	Systematic review and meta-analysis	IPL probably improves dry eye symptoms due to meibomian gland dysfunction versus placebo, although incremental benefit over standard care and certainty of safety evidence remain less clear.	1a
Tang et al., 2025 [33]	Retrospective comparative study	Narrow-band IPL performed strongly for erythema and porphyrin reduction, while broad-band IPL reduced sebum most but caused more pigmentary change; pulsed dye laser offered a favorable balance of efficacy and tolerability in rosacea.	2b
Tian et al., 2025 [34]	Preclinical animal study	A novel microsecond-pulse IPL improved erythema, reduced inflammatory cells and vessels, and appeared to improve barrier permeability in rosacea-like mice.	5
Lai et al., 2025 [35]	Observational clinical study	IPL improved symptoms and tear-film outcomes in dry eye after SMILE surgery compared with conventional medication, though the study remained nonrandomized.	2b
Wang et al., 2025 [36]	Translational study	AOPT-LTL IPL reduced pigmentation, erythema, inflammatory mediators, angiogenic signals, and SCF/c-KIT pathway activity in melasma, with supportive clinical improvement in a small cohort.	4
Chen et al., 2025 [37]	Systematic review and network meta-analysis	Both IPL and LipiFlow improved meibomian gland dysfunction outcomes versus controls; indirect comparisons suggested different strengths across endpoints, but no head-to-head trials were available.	1a
Li et al., 2025 [38]	Bibliometric analysis	Demonstrated rapid growth of IPL research in dry eye disease, especially in ophthalmology and photomedicine, but did not evaluate clinical efficacy directly.	5
Teerawatanapong et al., 2025 [39]	Randomized single-blind split-area trial	Home-use IPL improved skin roughness in keratosis pilaris compared with sham treatment, although erythema and hyperpigmentation differences were not significant and no severe adverse events occurred.	1b
Lipka-Trawińska et al., 2025 [40]	Prospective observational study	Quantitative image analysis documented significant reductions in vascular lesion metrics and improved skin homogeneity after IPL, highlighting the value of objective assessment methods.	2b
Liu et al., 2025 [41]	Systematic review and meta-analysis	IPL improved Demodex eradication rates in ocular demodicosis and showed a trend toward lowering mite counts, with no major adverse events reported.	1a
Chikhalkar et al., 2025 [42]	Clinical study	Three sessions of 590-nm vascular-mode IPL improved erythema and burning symptoms in topical steroid-damaged facies.	4
Chan et al., 2025 [43]	Systematic review and meta-analysis	Combined low-level light therapy and IPL improved OSDI, tear breakup time, and Schirmer test results in meibomian gland dysfunction, although heterogeneity was high for several endpoints.	1a

Table 1. *Cont.*

Author/Year	Study Design	Key Findings	Evidence Level
Hwang et al., 2025 [44]	Experimental study	IPL showed wavelength- and intensity-dependent microbial inactivation, suggesting a possible mechanistic basis for benefit in acneiform or blepharitic disorders.	5
Fu et al., 2025 [45]	Retrospective study	Low-energy delicate pulsed light improved symptom scores, clinician erythema ratings, and VISIA redness in sensitive skin, without obvious adverse effects.	2b
Zhang et al., 2025 [46]	Retrospective clinical observation	IPL or LED added to hydroxychloroquine and topical repair therapy outperformed medication alone in rosacea, with the IPL combination showing the highest effective rate.	2b
Kochergin et al., 2025 [47]	Practical review	Suggested that IPL may help correct post-acne pigmentary, erythematous, and textural sequelae, although the evidence was mainly conceptual rather than controlled.	5
Wang et al., 2025 [48]	Case report	Reported a macular hole with persistent photoreceptor and retinal pigment epithelium damage after accidental ocular IPL exposure without protection, emphasizing the need for strict eye safety.	4
Tang et al., 2025 [49]	Prospective randomized study	Sequential triple therapy with microneedling, hydrolifting, and IPL outperformed hydrolifting alone and IPL monotherapy for facial inflammation, without increased adverse events.	1b
Guo et al., 2025 [50]	Technical clinical report	IPL depilation appeared safe and effective for hair removal in autologous reconstructed auricles, extending IPL use into reconstructive practice.	4
Liu et al., 2025 [51]	Randomized trial	IPL combined with topical 3% tranexamic acid achieved better erythema reduction, overall efficacy, and quality-of-life outcomes than IPL alone in facial erythema associated with acne vulgaris and rosacea.	1b
Weng et al., 2025 [52]	Prospective randomized study	IPL plus postoperative radiotherapy improved Vancouver Scar Scale, POSAS, pain, and itch outcomes in chest keloids compared with radiotherapy alone.	1b
Chen et al., 2024 [53]	Narrative review	Concluded that IPL has established value in meibomian gland dysfunction and promising potential in blepharitis, recurrent chalazia, and related ocular surface diseases.	5
Lin et al., 2024 [54]	Safety review	Highlighted unresolved safety concerns regarding IPL, including oxidative stress, inflammatory activation, senescence, and possible photoaging or photocarcinogenic signals if used improperly.	5
Leal-Silva et al., 2024 [55]	Review	Summarized IPL hair removal history, mechanism, patient selection, and clinical utility; mainly provided background-supportive rather than novel outcome data.	5
Ruan et al., 2024 [56]	Randomized trial	PDL, DPL, M22 590, and M22 vascular-filter IPL all improved erythematotelangiectatic rosacea; no clear efficacy difference emerged, although vascular-filter IPL caused more blistering.	1b
Piccolo et al., 2024 [57]	Prospective clinical study	A vascular chromophore-specific IPL system produced good or excellent improvement in facial vascular lesions, including rosacea-associated lesions, with minimal adverse effects.	2b
Jiang et al., 2024 [58]	Randomized study	IPL achieved higher cure and efficacy rates than hot compresses for chalazion in children, especially granulomatous chalazia, without adverse reactions.	1b
Lee et al., 2024 [59]	Technical case-sharing review	Emphasized consultation, patch testing, individualized parameters, aftercare, and prolonged treatment courses when using IPL for post-inflammatory hyperpigmentation.	4

Table 1. *Cont.*

Author/Year	Study Design	Key Findings	Evidence Level
Wang et al., 2024 [60]	Systematic review and meta-analysis	Laser or IPL treatment improved early surgical scar outcomes with minimal serious adverse events, although IPL-specific effects were not isolated from other laser modalities.	1a
Martignago et al., 2024 [61]	Systematic review	Most included rosacea studies showed meaningful improvement in erythema and telangiectasia after IPL, but methodological quality and protocol heterogeneity remained substantial.	1a
Chan et al., 2024 [62]	Case-based clinical report	Described successful treatment of mixed hypertrophic scar, post-inflammatory hyperpigmentation, and post-inflammatory hypopigmentation with IPL.	4
Dobroshi, 2024 [63]	Retrospective observational study	A narrowband IPL module produced favorable blinded GAIS and patient satisfaction scores in pigmented lesions, with minimal adverse events.	2b
Zhai et al., 2024 [64]	Meta-analysis	IPL and PDL showed no significant difference in rosacea clearance above 50% or erythema index reduction; IPL had a slight advantage for higher-grade clearance, while PDL appeared less painful.	1a
Wang et al., 2024 [65]	Case series	IPL combined with low-dose intralesional corticosteroids improved noninfectious granulomas after mesotherapy, with high satisfaction and no recurrence or adverse reactions reported.	4
Clague et al., 2024 [66]	Case series	Hyperdiluted botulinum toxin alone or alternating with IPL improved hypertrophic scar size, appearance, and erythema over six months.	4
Shergill et al., 2024 [67]	Scoping review	Most patients with ocular rosacea treated with IPL showed partial response and limited adverse events, although the evidence base remained small and complete recovery was not reported.	5

4. Discussion

The contemporary literature reviewed here supports a clear shift in how IPL should be conceptualized in clinical practice. Rather than functioning as a single-purpose device for vascular or pigmentary lesions, IPL now appears better understood as a flexible treatment platform with applications across inflammatory dermatoses, periocular disease, rejuvenation, scar modulation, dyschromia, and selected reconstructive indications. At the same time, the evidence base remains uneven. The most persuasive data are concentrated in erythematotelangiectatic rosacea and meibomian gland dysfunction (MGD)-related ocular surface disease, where randomized trials, systematic reviews, and meta-analyses consistently report benefit. In contrast, many newer indications remain supported primarily by retrospective studies, case series, or mechanistic reports, which are clinically interesting but insufficient to define standardized treatment algorithms. Thus, the present review suggests that IPL has matured into a multipurpose modality, but not all its expanding uses yet carry the same evidentiary weight [21,53,64,67].

Among dermatologic indications, rosacea remains the most mature and clinically defensible use of IPL. Recent comparative and pooled evidence suggests that IPL provides meaningful improvement in erythema, telangiectasia, symptom burden, and quality of life, with efficacy that is broadly comparable to pulsed dye laser (PDL) in many settings [21,33,57,64]. Importantly, these data also show that "IPL" is not a uniform intervention. Narrow-band, broad-band, vascular-filter, and chromophore-specific systems may behave differently with respect to erythema reduction, porphyrin clearance, sebum modulation, pigmentary change, and tolerability [33,56,57]. This observation has practical significance because it explains why studies using the generic term IPL often appear heterogeneous even when targeting the same phenotype. It also suggests that future rosacea studies should describe device spectrum, filter selection, pulse structure, fluence, and cooling with greater precision. The existing literature supports IPL as an effective option for vascular rosacea, but also indicates that device configuration and patient phenotype are likely major determinants of success [21,33,56,64].

Another important development is the expansion of IPL from purely vascular targeting toward broader anti-inflammatory and tissue-modulating roles. This is especially evident in ocular surface disease, where the therapeutic rationale extends beyond classical selective photothermolysis. In MGD and related dry eye syndromes, randomized and meta-analytic data generally support improvement in symptoms, tear film stability, gland function, and ocular surface

parameters after IPL [27,32,43,53]. The randomized trial by Tang et al. further suggests that IPL may perform best when combined with procedures that directly address gland obstruction, such as deep eyelid margin cleaning [27]. Meanwhile, indirect comparative evidence indicates that IPL may offer outcomes comparable to or better than some device-based alternatives for selected endpoints, though head-to-head trials remain lacking [37]. Beyond MGD, the literature also suggests potential benefit in ocular demodicosis, ocular rosacea, and chalazion, including pediatric chalazia, thereby broadening the clinical territory of periocular IPL [41,53,58,67]. Collectively, these findings reinforce the view that IPL may influence inflammation, meibum quality, microbial ecology, and peri-glandular vascular activity in parallel, which likely explains its growing relevance in ophthalmology [27,43,53,67].

The recent translational literature strengthens this broader mechanistic interpretation. In rosacea-like mice, microsecond-pulse IPL reduced erythema, vascular markers, inflammatory cell infiltration, and barrier dysfunction, suggesting that clinical benefit may derive from combined vascular, immunologic, and barrier-restorative effects rather than vessel coagulation alone [34]. Likewise, in melasma-oriented translational work, IPL was associated with reductions in inflammatory mediators, angiogenic signaling, mast-cell infiltration, and SCF/c-KIT pathway activity, again implying that its action may extend into pathways of chronic inflammation and pigment regulation [36]. Experimental work on microbial inactivation also provides a theoretical basis for benefit in acneiform, blepharitic, or biofilm-associated disease states, although such laboratory findings cannot be assumed to translate directly into clinical efficacy [44]. These mechanistic studies do not substitute for controlled clinical trials, but they do help explain why IPL may show benefit in disorders that are not purely vascular or pigmentary and why it may integrate particularly well into phenotype-directed multimodal treatment strategies [34,36,44].

Combination therapy is arguably the most important theme emerging from the current review. Several studies suggest that IPL may be most valuable when incorporated into treatment programs designed around mixed disease biology rather than used as monotherapy. In post-traumatic hyperpigmentation, IPL combined with fractional CO_2 laser produced better outcomes than either modality alone, supporting a synergistic interaction between pigment-directed treatment and dermal remodeling [19]. Similar logic is seen in postburn hyperpigmentation treated with IPL and collagen dressing, facial erythema treated with IPL plus topical tranexamic acid, facial inflammation treated with microneedling and hydrolifting before IPL, and ocular MGD treated with adjunctive gland cleaning [22,27,49,51]. In rejuvenation and photoaging, combination with mesotherapy also appears promising, though attribution of benefit is limited by the absence of monotherapy controls in some studies [23]. Across these reports, IPL appears to function as a versatile component within broader treatment sequences, especially when vascular, inflammatory, pigmentary, and textural factors coexist. This multimodal role may ultimately prove more clinically important than any attempt to position IPL as a universally superior stand-alone device [19,22,49,51].

This point is particularly relevant in pigmentary disorders. The reviewed literature suggests that IPL may have utility in post-inflammatory hyperpigmentation, post-traumatic hyperpigmentation, postburn dyschromia, melasma, and mixed scar-dyspigmentation states, but the strength of evidence differs substantially across these conditions [19,36,59,63]. For melasma, current publications support cautious optimism rather than firm endorsement. Narrative and translational evidence suggests that IPL may be beneficial, particularly where vascular and inflammatory components coexist, but controlled monotherapy data remain limited and recurrence risk, maintenance strategy, and patient selection remain insufficiently defined [30,36]. By contrast, experience-based and retrospective studies in post-inflammatory or post-traumatic dyschromia suggest that IPL may be useful when carefully titrated over repeated sessions, particularly in mixed lesions that are poorly addressed by single-target devices [19,22,59,62]. These reports are clinically meaningful because real-world dyschromia often involves concurrent vascular instability, inflammation, and altered texture. However, protocol heterogeneity and small sample sizes still limit broad generalization [19,22,62,63].

Scar management represents another expanding field in which IPL is increasingly being used not only for established erythematous scars but also as part of early or preventive intervention. Evidence from vascular hypertrophic scar studies suggests that IPL can reduce erythema and vascularity, with instrumental imaging lending support to visible clinical improvement [28]. Postoperative or early intervention frameworks are also emerging. In chest keloids, adding IPL to postoperative radiotherapy improved scar quality and symptom burden, while broader evidence indicates that early energy-based intervention can improve scar outcomes with minimal serious adverse effects, even if IPL-specific contributions are not always isolated from other laser modalities [52,60]. Case-based reports further suggest potential roles for IPL in mixed hypertrophic scar and pigmentary states, as well as in novel combination protocols with corticosteroids or hyperdiluted botulinum toxin [62,65,66]. Although these findings are encouraging, scar biology is complex and scar outcomes are highly sensitive to timing, anatomical site, tension, adjunctive therapy, and baseline scar phenotype. Accordingly, scar-related IPL should still be regarded as promising but incompletely standardized, especially outside vascular-predominant hypertrophic lesions [28,52,60,66].

In aesthetic dermatology, the available data support IPL as an effective skin-quality intervention, especially when delivered longitudinally and with attention to post-procedure care. Real-world evidence indicates that repeated IPL sessions can improve erythema, pigmentation, wrinkles, and global skin appearance, while treatment interval regularity and

cumulative session number appear to influence outcome [20]. Additional studies suggest benefit in photoaging when IPL is combined with mesotherapy and in sensitive skin when low-energy protocols are used, implying that dose and protocol refinement may expand tolerability in more reactive populations [23,45]. The split-face skincare study is also clinically relevant because it highlights the importance of barrier recovery and supportive cosmeceutical care in maximizing patient comfort and perhaps treatment satisfaction after IPL [24]. These studies collectively support the practical observation that IPL outcomes are often cumulative, maintenance-dependent, and closely linked to peri-procedural skin support. However, aesthetic studies frequently rely on uncontrolled designs, subjective scales, or manufacturer-adjacent endpoints, so stronger comparative trials remain necessary before specific rejuvenation regimens can be recommended with confidence [20,23,45].

The reviewed literature also points to several niche but clinically meaningful applications that broaden the procedural identity of IPL. These include home maintenance epilation after pilonidal surgery, depilation of reconstructed auricles, keratosis pilaris treated with home-use IPL, hidradenitis-associated multimodal scar management, and treatment of steroid-damaged facies [25,26,39,55]. These indications illustrate the adaptability of IPL in both institutional and home settings, but they also underscore a recurring problem in the literature: feasibility is often demonstrated before efficacy is rigorously quantified. Small case series and proof-of-concept studies are valuable for innovation, yet they should not be mistaken for evidence of durable superiority over standard care. The same caution applies to post-acne sequelae and procedure-related granulomatous reactions, where early reports suggest that IPL may be useful in carefully selected mixed inflammatory or dyschromic presentations, but confirmatory trials are absent [47,65]. These emerging applications are best interpreted as signals of clinical potential rather than settled standards of care [25,42,47,65].

Safety remains a critical issue, particularly because IPL is often perceived as gentler than lasers. Most reviewed studies reported transient and generally mild adverse effects, and serious complications were uncommon in appropriately selected patients [19,20,57,63]. Nevertheless, recent literature rightly challenges any complacency regarding safety. Parameter-dependent pigmentary change, blistering, and variable tolerability remain relevant in darker phototypes and with certain wavelength configurations [20,33,56]. More importantly, the case of macular hole after accidental ocular exposure is a stark reminder that IPL used near the eye requires meticulous shielding and operator discipline [48]. Broader safety reviews have also raised concern regarding oxidative stress, inflammatory activation, senescence-associated pathways, and theoretical long-term photoaging or photocarcinogenic risk if treatments are performed improperly or excessively, although the clinical implications of these biomarker-level findings remain uncertain [54]. Taken together, the current evidence supports IPL as generally safe in experienced hands, but only when careful patient selection, parameter customization, and procedural safeguards are rigorously applied [48,54].

The main limitation across indications is persistent heterogeneity. Studies differ in device platform, filter spectrum, pulse sequencing, energy settings, treatment frequency, comparator choice, concurrent therapies, follow-up duration, and endpoint definition. Many are retrospective, underpowered, or based on mixed diagnostic groups, which complicates meta-analysis and weakens the ability to form unified clinical pathways [33,45,46,61]. Even in relatively mature fields such as rosacea and MGD, direct head-to-head trials between IPL platforms, comparators, and combination regimens remain scarce [32,37,61,64]. Future research should therefore prioritize indication-specific randomized trials with protocol transparency, stratification by phenotype and phototype, objective imaging or instrumental biomarkers, and longer follow-up to assess relapse and maintenance needs. Such work is especially important in melasma, scar modulation, post-inflammatory dyschromia, and reconstructive applications, where current evidence is encouraging but still preliminary [28,52,60].

In summary, the current literature positions IPL as a genuinely versatile therapeutic platform whose strongest evidence lies in vascular rosacea and MGD-related ocular surface disease, with additional promise in rejuvenation, dyschromia, scar care, and selected reconstructive or inflammatory indications [21,27,64,67]. Its future value will likely depend less on whether it outperforms every comparator as monotherapy and more on how intelligently it is integrated into phenotype-based, multimodal treatment strategies [19,52,65,66]. The field has clearly progressed beyond the idea of IPL as merely a substitute for vascular laser therapy. However, broader adoption across newer indications should proceed with methodological caution, protocol refinement, and continued attention to safety, durability, and patient-specific customization [30,48,54,61].

5. Conclusions

Current evidence confirms that intense pulsed light has progressed from a narrow aesthetic technology into a versatile clinical platform with meaningful applications in dermatology and ophthalmology. Its strongest support lies in erythematotelangiectatic rosacea, meibomian gland dysfunction, and selected rejuvenation protocols, where consistent improvements in vascular signs, ocular symptoms, and overall skin quality have been demonstrated. Emerging roles in pigmentary disorders, scar management, postoperative care, and reconstructive indications are promising, especially when IPL is incorporated into multimodal treatment strategies. However, wider adoption still requires better protocol standardization, clearer patient selection, longer follow-up, and direct comparative trials. Future research should focus on

phenotype-based customization, durability of response, rigorous long-term safety evaluation, and stronger evidence for combination-based therapeutic algorithms.

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