



Comparing Pulsed Dye Laser and Intralesional Steroid Injection for Nail Psoriasis: Efficacy, Safety, and Practical Considerations

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Abstract

Background: Nail psoriasis is a common and often challenging manifestation of psoriasis, affecting up to 50% of patients with cutaneous disease and up to 80–90% of those with psoriatic arthritis. It is associated with significant functional impairment, pain, and psychosocial burden, while also serving as a predictor of more severe systemic involvement. Management remains difficult due to the unique anatomy of the nail unit, limited drug penetration, and frequent recalcitrance to conventional topical therapies. Among localized treatment options, intralesional corticosteroid injections and pulsed dye laser (PDL) therapy have emerged as important modalities with distinct mechanisms of action and clinical profiles.

The aim of this review is to comprehensively compare pulsed dye laser and intralesional corticosteroid injection in the treatment of nail psoriasis, focusing on their efficacy, safety, and practical applicability in clinical settings. Intralesional corticosteroids, most commonly triamcinolone acetonide, act through potent anti-inflammatory and immunosuppressive effects targeting the nail matrix and bed. In contrast, PDL operates via selective photothermolysis of abnormal vasculature, reducing angiogenesis and inflammation associated with psoriatic pathology.

Available evidence suggests that both modalities can achieve meaningful improvement in Nail Psoriasis Severity Index (NAPSI) scores, though their response patterns differ depending on nail involvement (matrix versus bed disease). Intralesional steroids tend to show pronounced efficacy in matrix-related changes but are limited by procedure-related pain and potential adverse effects such as nail dystrophy and atrophy. PDL offers a non-invasive alternative with favorable tolerability and a lower risk of structural nail damage, though it may require multiple sessions and specialized equipment.

In conclusion, both pulsed dye laser and intralesional corticosteroid injection represent valuable options for the management of nail psoriasis. Treatment selection should be individualized based on disease characteristics, patient tolerance, resource availability, and clinician expertise. Further high-quality comparative studies are needed to establish standardized protocols and optimize patient outcomes.

Keywords: *Pulsed Dye Laser, Intralesional Steroid Injection Nail Psoriasis, Clinical Efficacy*



Introduction

Nail psoriasis represents a clinically significant manifestation of psoriasis, involving the nail matrix, nail bed, or both, and contributing substantially to disease burden. It is estimated that up to 50% of patients with cutaneous psoriasis develop nail involvement during their lifetime, with prevalence increasing to as high as 80–90% among individuals with psoriatic arthritis. The condition is not merely cosmetic; it can result in pain, functional limitations, and impairment in fine motor activities, thereby negatively affecting quality of life. In addition, nail psoriasis has been increasingly recognized as a marker of more severe disease and a predictor of joint involvement, underscoring its importance in comprehensive patient evaluation [1].

Clinically, nail psoriasis presents with a spectrum of features depending on the anatomical site affected. Nail matrix involvement typically manifests as pitting, leukonychia, red spots in the lunula, and nail plate crumbling, while nail bed disease is associated with onycholysis, subungual hyperkeratosis, splinter hemorrhages, and the characteristic “oil drop” discoloration. These diverse manifestations often coexist, making management more complex and necessitating targeted therapeutic strategies. The unique structure of the nail unit, particularly the protective nail plate barrier, further complicates treatment by limiting the penetration and effectiveness of topical agents [2].

Despite the availability of multiple therapeutic options, the management of nail psoriasis remains challenging. Topical therapies often yield suboptimal results, especially in moderate-to-severe cases, while systemic agents may not always be justified in patients with isolated nail disease due to potential adverse effects. As a result, localized treatments such as intralesional corticosteroid injections and device-based therapies like pulsed dye laser (PDL) have gained increasing attention as effective alternatives for targeted intervention [3].

Intralesional corticosteroid injection, most commonly using triamcinolone acetonide, has long been considered a cornerstone therapy for nail psoriasis, particularly for matrix involvement. Its mechanism is based on potent anti-inflammatory and immunosuppressive effects that reduce keratinocyte proliferation and inflammatory infiltration. However, the procedure is often associated with significant pain, requires technical expertise, and carries risks such as nail dystrophy, hypopigmentation, and atrophy, which may limit patient acceptance and adherence [4].

On the other hand, pulsed dye laser therapy has emerged as a promising non-invasive modality that targets the vascular component of psoriatic inflammation through selective photothermolysis. By reducing abnormal capillary proliferation and associated inflammatory mediators, PDL offers a mechanistically distinct approach to treatment. It is generally well tolerated, with minimal downtime and a favorable safety profile, although accessibility, cost, and the need for multiple treatment sessions remain practical considerations [5,6].

Given the growing interest in both modalities, there is a need for a comprehensive comparison that evaluates not only their efficacy but also safety, tolerability, and real-world applicability. Current literature provides evidence supporting each approach; however, direct comparisons remain limited, and clinical decision-making is often guided by individual experience rather than standardized evidence-based recommendations. This highlights a critical gap in the literature that warrants focused analysis.

The aim of this review is to compare pulsed dye laser and intralesional corticosteroid injection in the management of nail psoriasis, with particular emphasis on efficacy outcomes, safety profiles, and practical considerations in clinical practice. By synthesizing available evidence, this article seeks to provide clinicians with a clearer framework for selecting the most appropriate treatment modality tailored to individual patient needs.

Epidemiology and Clinical Burden of Nail Psoriasis

Nail psoriasis is a highly prevalent manifestation of psoriasis, with studies indicating that approximately 40–50% of patients with cutaneous psoriasis exhibit nail involvement at any given time, and up to 80–90% develop nail changes over the course of their disease. The prevalence is even higher among patients with psoriatic arthritis, where nail involvement is considered a hallmark feature and may precede or



accompany joint disease. This strong association is thought to reflect shared anatomical and inflammatory pathways between the nail unit and distal interphalangeal joints [7].

The epidemiological distribution of nail psoriasis varies according to disease severity, duration, and patient demographics. It is more frequently observed in patients with long-standing psoriasis and those with severe skin involvement. Male patients and individuals with early-onset psoriasis may also exhibit a higher prevalence of nail disease, although findings across studies are somewhat heterogeneous. Importantly, nail psoriasis can occur as an isolated finding in a subset of patients, which may delay diagnosis or lead to misclassification as other nail disorders such as onychomycosis [8].

From a clinical perspective, nail psoriasis encompasses a broad spectrum of morphological changes depending on the site of pathology. Matrix involvement leads to features such as pitting and nail plate dystrophy, while nail bed disease manifests as onycholysis, subungual hyperkeratosis, and discoloration. The coexistence of these features often results in significant nail deformity, which can be both functionally disabling and cosmetically distressing. Fingernails are more commonly affected than toenails, although both can be involved simultaneously [9].

The burden of nail psoriasis extends beyond physical symptoms, significantly impacting patients' quality of life. Functional impairment is common, particularly in activities requiring fine motor skills, such as writing, typing, or buttoning clothes. Pain and tenderness may further limit daily activities. In addition, the visible nature of nail abnormalities can lead to social embarrassment, stigma, and psychological distress, including anxiety and depression. These effects are often underrecognized in routine clinical practice, despite their substantial contribution to overall disease burden [10].

Nail psoriasis also has important prognostic implications. It is increasingly recognized as a predictor of psoriatic arthritis, with longitudinal studies demonstrating that patients with nail involvement are at higher risk of developing joint disease. The anatomical relationship between the nail unit and the enthesis of the distal interphalangeal joint provides a plausible explanation for this association. As such, careful evaluation of nail changes can serve as an important clinical clue prompting early screening for musculoskeletal symptoms [11].

In terms of healthcare impact, nail psoriasis contributes to increased healthcare utilization due to its chronicity, treatment resistance, and need for repeated interventions. Patients often require prolonged therapy with variable responses, leading to frustration and reduced adherence. The lack of standardized treatment protocols further complicates management, particularly in cases of isolated nail disease where systemic therapy may not be appropriate. This underscores the importance of effective, localized treatment options such as intralesional corticosteroids and pulsed dye laser [12].

Overall, nail psoriasis represents a common, burdensome, and clinically significant component of psoriatic disease. Its high prevalence, association with systemic involvement, and profound impact on quality of life highlight the need for targeted and effective therapeutic strategies. Understanding its epidemiology and burden provides essential context for evaluating and comparing treatment modalities in subsequent sections of this review. [13]

Pathophysiology of Nail Psoriasis Relevant to Treatment Response

Nail psoriasis is driven by immune-mediated inflammation involving the nail matrix and nail bed, closely mirroring the pathogenic mechanisms observed in cutaneous psoriasis. Central to this process is the activation of dendritic cells and T lymphocytes, particularly Th1 and Th17 subsets, which release pro-inflammatory cytokines such as tumor necrosis factor-alpha (TNF- α), interleukin (IL)-17, and IL-23. These mediators promote keratinocyte hyperproliferation, abnormal differentiation, and sustained inflammation within the nail unit [14].

The anatomical distinction between the nail matrix and nail bed is critical in understanding both clinical manifestations and treatment response. Matrix involvement leads to defective nail plate formation, resulting in pitting and crumbling, while nail bed inflammation causes onycholysis, subungual hyperkeratosis, and discoloration. This compartmentalization explains why certain therapies demonstrate variable efficacy depending on the predominant site of disease [15].

A key feature of psoriatic pathology is angiogenesis, characterized by dilated and tortuous capillaries



within the nail bed and surrounding tissues. This vascular proliferation not only sustains inflammation but also contributes to clinical signs such as erythema and splinter hemorrhages. The prominence of vascular changes provides a mechanistic basis for therapies like pulsed dye laser, which selectively targets hemoglobin to induce photothermolysis of abnormal vessels [16].

In contrast, intralesional corticosteroids exert their effect by broadly suppressing inflammatory pathways. By inhibiting cytokine production, reducing T-cell activation, and decreasing keratinocyte proliferation, corticosteroids directly modulate the immune processes driving both matrix and nail bed disease. Their localized delivery allows for higher concentrations at the site of pathology, particularly within the matrix, which is otherwise difficult to reach with topical therapies [17].

The structural barrier of the nail plate remains a major obstacle in treatment, limiting drug penetration and contributing to therapeutic resistance. This challenge highlights the advantage of injectable and device-based therapies, which bypass or overcome this barrier through direct delivery or targeted physical mechanisms. As a result, both intralesional steroids and PDL have gained importance as localized treatment options for refractory nail psoriasis [18].

Overall, the pathophysiology of nail psoriasis underscores the rationale for these two modalities: corticosteroids address the immune-inflammatory cascade, while PDL targets the vascular component of disease. Understanding these mechanisms is essential for interpreting differences in efficacy, safety, and clinical applicability between the two approaches. [19]

Clinical Assessment and Outcome Measures

Accurate clinical assessment of nail psoriasis is essential for evaluating treatment response and comparing therapeutic modalities such as pulsed dye laser (PDL) and intralesional corticosteroid injection. The most widely used and validated scoring system is the Nail Psoriasis Severity Index (NAPSI), which assesses both nail matrix and nail bed involvement by dividing the nail into quadrants and scoring specific features. While NAPSI provides a standardized framework, it does not always capture subtle clinical improvements or patient-reported outcomes, which are particularly relevant when comparing interventions with different mechanisms of action [20].

From a comparative standpoint, NAPSI allows differentiation between matrix-dominant and bed-dominant disease, which is critical when evaluating PDL versus steroid injections. Intralesional corticosteroids tend to show greater efficacy in matrix-related features such as pitting and nail plate dystrophy, due to direct delivery into or near the matrix. In contrast, PDL demonstrates relatively stronger effects on nail bed pathology, including erythema, onycholysis, and subungual hyperkeratosis, owing to its vascular-targeting mechanism. Therefore, changes in total NAPSI score should be interpreted alongside subcomponent analysis to avoid misleading conclusions [21].

Modified versions of NAPSI, including target NAPSI (tNAPSI), have been used in clinical studies to improve sensitivity and reduce inter-observer variability. These tools are particularly useful in split-nail or intra-patient comparative studies, where one nail is treated with PDL and another with intralesional steroids. Such designs enhance the reliability of direct comparisons by minimizing patient-level confounders, including systemic disease activity and genetic variability [22].

In addition to objective scoring systems, patient-reported outcomes play an important role in comparative evaluation. Pain, functional limitation, and cosmetic satisfaction are key parameters that may differ significantly between the two modalities. Intralesional steroid injections are often associated with considerable procedural pain, which may negatively influence patient perception despite clinical improvement. Conversely, PDL is generally better tolerated, and improvements in nail appearance may translate more directly into patient satisfaction, even when objective score reductions are modest [23].

Another important aspect of assessment is the timeline of response. Intralesional corticosteroids may produce relatively rapid improvement in matrix lesions, whereas PDL often requires multiple treatment sessions over several weeks to achieve noticeable results. Consequently, the timing of outcome measurement in clinical studies can significantly influence perceived efficacy. Early assessments may favor steroid injections, while longer follow-up periods may better reflect the cumulative benefits of PDL [24].



Photographic documentation and dermoscopic evaluation have also been increasingly utilized to enhance assessment accuracy. Dermoscopy, in particular, can visualize capillary changes and hemorrhages, providing insight into vascular response following PDL treatment. These tools may help detect early improvements not captured by conventional scoring systems and offer an additional layer of comparison between therapies [25].

Overall, while NAPS and its variants remain the cornerstone of clinical evaluation, a comprehensive comparative assessment between PDL and intralesional corticosteroids requires integration of objective scores, subsite analysis (matrix vs bed), patient-reported outcomes, and temporal response patterns. Such a multidimensional approach is essential for accurately determining the relative benefits of each modality in clinical practice. [26]

Intralesional Steroid Injection: Mechanism, Technique, and Rationale

Intralesional corticosteroid injection, most commonly using triamcinolone acetonide, is a well-established localized treatment for nail psoriasis, particularly in cases with predominant nail matrix involvement. Its therapeutic effect is primarily mediated through potent anti-inflammatory and immunosuppressive actions, including inhibition of pro-inflammatory cytokines such as TNF- α , IL-17, and IL-23, as well as suppression of T-cell activation and keratinocyte hyperproliferation. By directly targeting the inflammatory milieu within the nail unit, intralesional steroids can effectively reduce pathological changes responsible for nail dystrophy [27].

From a comparative perspective, intralesional corticosteroids offer a key advantage in their ability to deliver high drug concentrations precisely to the site of pathology, especially the nail matrix, which is otherwise difficult to access with topical therapies. This targeted delivery explains their superior efficacy in treating matrix-related features such as pitting, ridging, and nail plate crumbling. In contrast, their effect on nail bed manifestations, including onycholysis and subungual hyperkeratosis, tends to be less consistent when compared with modalities like pulsed dye laser that specifically address vascular pathology [28].

The injection technique is critical for both efficacy and safety. Typically, triamcinolone acetonide at concentrations ranging from 2.5 to 10 mg/mL is injected into the proximal nail fold or directly into the nail matrix region using a fine-gauge needle. In some approaches, injections are also administered into the nail bed for distal disease. Procedures are usually repeated at intervals of 4–6 weeks, depending on clinical response. However, the technical difficulty of accurately targeting the matrix without causing damage requires considerable operator expertise [29].

Pain is one of the most significant limitations of intralesional steroid therapy and represents a major differentiating factor when compared to PDL. The nail unit is highly innervated, and injections are often associated with substantial discomfort, sometimes necessitating the use of local anesthesia, nerve blocks, or cooling techniques. This procedural pain can negatively affect patient compliance, particularly when multiple nails or repeated sessions are required [30].

Adverse effects associated with intralesional corticosteroids are generally localized but can be clinically significant. These include nail plate atrophy, hypopigmentation, telangiectasia, and, in some cases, permanent nail dystrophy due to matrix damage. The risk of such complications is influenced by injection depth, concentration, and frequency, highlighting the importance of proper technique and cautious dosing. Compared to PDL, which has a more favorable safety profile, these risks may limit the widespread acceptance of steroid injections among patients [31].

Despite these limitations, intralesional corticosteroids remain a highly effective and relatively accessible treatment option, particularly in resource-limited settings where laser devices may not be available. They are especially useful in patients with isolated nail matrix disease or when rapid improvement is desired. However, their invasive nature and tolerability issues necessitate careful patient selection and counseling [32].

In summary, intralesional steroid injection provides strong efficacy for matrix-dominant nail psoriasis through direct immunosuppressive effects, but is limited by pain, technical challenges, and potential adverse effects. These characteristics form an important basis for comparison with pulsed dye laser,



which offers a non-invasive, vascular-targeted alternative with a different efficacy and safety profile. [33]

Pulsed Dye Laser: Mechanism, Parameters, and Rationale in Nail Psoriasis

Pulsed dye laser (PDL) has emerged as a targeted, non-invasive therapeutic modality for nail psoriasis, with a mechanism specifically aligned to the vascular and inflammatory components of psoriatic pathology. Typically operating at wavelengths of 585–595 nm, PDL selectively targets oxyhemoglobin within dilated and tortuous capillaries characteristic of psoriatic lesions. Through the principle of selective photothermolysis, laser energy is absorbed by these vessels, resulting in thermal damage, vascular collapse, and subsequent reduction in local inflammation [34].

In nail psoriasis, angiogenesis plays a central role in sustaining chronic inflammation within the nail bed and surrounding tissues. Capillary proliferation and dilation contribute to clinical features such as erythema, splinter hemorrhages, and the “oil drop” discoloration. By selectively destroying these abnormal microvessels, PDL reduces the delivery of inflammatory mediators and immune cells to the affected site. This vascular targeting distinguishes PDL mechanistically from intralesional corticosteroids, which act primarily through immunosuppression rather than vascular modulation [35]. PDL demonstrates particular efficacy in nail bed psoriasis, where vascular changes are more prominent. Clinical improvements are most consistently observed in features such as onycholysis, subungual hyperkeratosis, and discoloration. In contrast, its effect on nail matrix disease—such as pitting and nail plate dystrophy—is generally less pronounced, likely due to the deeper anatomical location of the matrix and limited penetration of laser energy through the nail plate [36].

Treatment protocols for PDL in nail psoriasis vary across studies but generally involve sessions at intervals of 3–6 weeks. Common parameters include fluences ranging from 6 to 10 J/cm², pulse durations of 0.45 to 10 ms, and spot sizes of 5–7 mm. Dynamic cooling devices are often used to protect the epidermis and enhance patient comfort. Multiple sessions (typically 3–6 or more) are required to achieve clinically meaningful improvement, reflecting the gradual nature of vascular remodeling and nail growth [37].

From a tolerability standpoint, PDL offers a significant advantage over intralesional steroid injections. The procedure is generally well tolerated, with patients experiencing only mild discomfort, often described as a snapping sensation. Adverse effects are minimal and transient, including purpura, erythema, or mild edema, which typically resolve within a few days. Importantly, the risk of permanent nail damage or structural dystrophy is considerably lower compared to invasive techniques [38].

Another practical advantage of PDL is its ability to treat multiple nails in a single session without a proportional increase in discomfort, making it particularly suitable for patients with extensive nail involvement. Additionally, the non-invasive nature of the procedure improves patient acceptance and adherence, especially in those who are reluctant to undergo repeated injections. However, limitations include the need for specialized equipment, higher cost, and limited availability in some clinical settings [39].

Comparatively, PDL provides a mechanistically distinct and complementary approach to intralesional corticosteroids. While steroids are more effective for matrix-driven pathology, PDL excels in targeting nail bed disease through vascular modulation. This distinction is critical when selecting therapy based on the predominant clinical presentation. In some cases, combination or sequential therapy may offer synergistic benefits, although robust evidence for such approaches remains limited [40].

In summary, pulsed dye laser represents an effective and well-tolerated treatment option for nail psoriasis, particularly for nail bed involvement. Its targeted action on psoriatic microvasculature, favorable safety profile, and non-invasive nature make it an attractive alternative or adjunct to intralesional corticosteroid injection. Understanding its specific role in the context of nail unit anatomy is essential for optimizing therapeutic outcomes. [41]

Evidence for Intralesional Steroid Injection

The evidence supporting intralesional corticosteroid injection in nail psoriasis is relatively well established compared with newer modalities, although it remains limited by small sample sizes and



variability in study design. Across clinical reviews and dermatology guidelines, intralesional triamcinolone acetonide is consistently recommended as an effective localized therapy, particularly for patients with involvement of a limited number of nails and predominant nail matrix disease. This positions steroid injection as a traditional standard against which other localized treatments, including pulsed dye laser (PDL), are often compared. [42]

Early clinical studies, including those by de Berker and Lawrence, demonstrated that direct injection of triamcinolone into the nail matrix and bed could lead to meaningful clinical improvement in psoriatic nail dystrophy. These studies established the procedural feasibility and therapeutic rationale for intralesional steroids, showing reductions in key features such as pitting, ridging, and onycholysis. Although these early investigations lacked modern randomized designs, they played a foundational role in integrating intralesional therapy into dermatologic practice. [43]

Subsequent prospective studies have confirmed the efficacy of intralesional steroids while attempting to improve tolerability. For example, the use of alternative delivery systems such as needle-free jet injectors has demonstrated significant reductions in target Nail Psoriasis Severity Index (tNAPSI) scores, with reported improvements of approximately 40–50%. These findings suggest that the therapeutic effect of corticosteroids is robust and reproducible, and that procedural pain—rather than lack of efficacy—is the primary limitation of this modality. [44]

More recent real-world and retrospective studies provide further support for intralesional steroid efficacy. In such analyses, repeated injections of triamcinolone acetonide into the nail matrix and bed have been associated with progressive reductions in NAPSI scores over multiple treatment sessions. Fingernails tend to respond more rapidly than toenails, likely due to differences in growth rate and vascular supply. Clinically meaningful endpoints such as NAPSI-50 and NAPSI-75 are achieved in a substantial proportion of treated nails, reinforcing the role of intralesional therapy as an effective intervention for localized disease. [45]

Despite these benefits, the limitations of intralesional corticosteroid injection are consistently highlighted in the literature. Pain during injection is a major barrier, often requiring adjunctive measures such as nerve blocks, cooling, or modified techniques. This issue becomes particularly significant when multiple nails are involved or when repeated sessions are required, reducing patient adherence and satisfaction compared with non-invasive modalities like PDL. [46]

Adverse effects, although localized, can be clinically significant. These include nail plate atrophy, hypopigmentation, telangiectasia, subungual hematoma, and, in some cases, permanent nail dystrophy due to matrix damage. The risk of complications is closely related to injection technique, depth, and corticosteroid concentration, emphasizing the importance of operator expertise. Compared with PDL, which has a lower risk of structural nail damage, these safety concerns may influence treatment selection in clinical practice. [47]

In summary, intralesional corticosteroid injection remains a highly effective and widely used treatment for nail psoriasis, particularly for matrix-dominant disease. However, its invasive nature, procedural pain, and potential for local adverse effects represent significant drawbacks. These factors are central to its comparison with pulsed dye laser, which offers a less invasive but mechanistically different approach, setting the stage for evaluating relative efficacy and tolerability in subsequent sections. [48]

Evidence for Pulsed Dye Laser

The evidence base for pulsed dye laser (PDL) in nail psoriasis consists primarily of small prospective studies, controlled intra-patient trials, and a limited number of comparative analyses. Although large randomized controlled trials are lacking, the available literature consistently demonstrates that PDL is effective in improving nail psoriasis, particularly in cases with predominant nail bed involvement. Its growing use in dermatologic practice is largely driven by its favorable tolerability profile and its mechanistically targeted approach to psoriatic vascular pathology. [49]

One of the early pivotal studies by Oram et al. evaluated the use of 595-nm PDL administered monthly for three sessions in patients with nail psoriasis. The study reported significant reductions in Nail Psoriasis Severity Index (NAPSI) scores, establishing PDL as a viable non-invasive alternative for



localized nail disease. Importantly, the protocol used in this study—moderate fluence with short pulse duration—has since been widely adopted in clinical practice, supporting the reproducibility of results. [50]

Further evidence from controlled trials, such as the study by Treewittayapoom et al., compared different pulse durations of 595-nm PDL in bilateral nail psoriasis. Both treatment arms demonstrated significant improvement in NAPSI scores over time, with no major difference between pulse durations. This suggests that the therapeutic effect of PDL is robust across a range of parameter settings, and that clinical outcomes may be less dependent on fine technical adjustments than on consistent treatment delivery over multiple sessions. [51]

Additional studies, including those by Fernández-Guarino et al., have shown that PDL can improve both nail matrix and nail bed features, although the response is typically more pronounced in nail bed pathology. Improvements are particularly evident in onycholysis, subungual hyperkeratosis, and erythematous changes, reflecting the vascular-targeted mechanism of the laser. These findings reinforce the concept that PDL is most effective when angiogenesis plays a central role in disease expression. [52] From a safety and tolerability standpoint, PDL demonstrates a clear advantage over intralesional corticosteroid injection. Most studies report only mild and transient adverse effects, such as purpura, erythema, or minimal discomfort during treatment. Unlike steroid injections, PDL does not carry a significant risk of nail matrix damage or permanent dystrophy, making it particularly suitable for repeated use and for patients with multiple affected nails. [53]

Recent systematic reviews and meta-analyses further support the efficacy of PDL in nail psoriasis, while also emphasizing the limitations of the current evidence base. These analyses confirm that PDL leads to significant reductions in NAPSI scores, especially in nail bed-dominant disease, but highlight the need for larger, well-designed randomized controlled trials to establish standardized treatment protocols and directly compare outcomes with other modalities such as intralesional corticosteroids. [54]

In summary, pulsed dye laser is an effective and well-tolerated treatment for nail psoriasis, with particular strength in addressing nail bed pathology. While its evidence base is smaller compared to intralesional steroids, its non-invasive nature and favorable safety profile make it an increasingly preferred option in clinical practice, especially when patient comfort and multi-nail involvement are key considerations. [55]

Direct Comparison of Efficacy

Direct comparative evidence between pulsed dye laser (PDL) and intralesional corticosteroid injection in nail psoriasis is limited, but available head-to-head studies suggest that both modalities provide broadly comparable overall clinical improvement. In a randomized intra-patient controlled study, where different nails in the same patient were treated with either PDL or intralesional steroid, both interventions resulted in significant reductions in Nail Psoriasis Severity Index (NAPSI) scores. The percentage improvement was slightly higher in the intralesional steroid group, but the difference was not statistically significant, indicating similar overall efficacy between the two approaches. [56]

However, total NAPSI reduction alone does not fully capture clinically relevant differences. A more meaningful comparison considers the pattern of response based on nail compartment involvement. Nail psoriasis is divided into matrix and nail bed disease, and treatment efficacy varies accordingly. Evidence suggests that PDL tends to be more effective in improving nail bed features such as onycholysis, erythema, and splinter hemorrhages, while intralesional corticosteroids demonstrate stronger effects on matrix-related abnormalities including pitting and nail plate dystrophy. Thus, similar overall NAPSI reductions may mask important differences in site-specific efficacy. [57]

Detailed clinical and dermoscopic assessments further support this distinction. In comparative settings, both PDL and intralesional steroids have shown improvement in features such as splinter hemorrhages and onycholysis, while improvements in subungual hyperkeratosis are often more limited. Matrix features such as pitting and crumbling may respond more consistently to steroid injections due to direct delivery to the site of pathology. These findings reinforce that while both modalities are effective, their mechanisms of action influence which clinical features improve most significantly. [58]



Another important consideration in comparing efficacy is the magnitude and timeline of response. Both modalities typically produce gradual improvement over multiple treatment sessions, reflecting the slow growth of the nail unit. However, intralesional corticosteroids may demonstrate relatively faster initial improvement in matrix lesions, whereas PDL often requires cumulative sessions to achieve optimal results. Consequently, short-term studies may slightly favor steroid injections, while longer follow-up may show more comparable outcomes between the two treatments. [59]

Interpretation of comparative efficacy is also limited by methodological issues in existing studies. Nail psoriasis trials often involve small sample sizes, short follow-up durations, and variability in scoring systems, all of which can obscure true differences between treatments. Additionally, the lack of standardized outcome measures and heterogeneity in treatment protocols further complicate direct comparison. These limitations suggest that apparent equivalence in efficacy should be interpreted cautiously. [60]

From a clinical perspective, the choice between PDL and intralesional corticosteroid injection should be guided by disease phenotype rather than overall efficacy alone. Intralesional steroids may be preferred in patients with isolated, matrix-dominant disease requiring targeted and potentially faster response. In contrast, PDL may be more suitable for patients with nail bed-predominant disease, multiple nail involvement, or those who prefer a non-invasive approach. This phenotype-based strategy reflects a more practical and individualized interpretation of the available evidence. [61]

Overall, current data indicate that PDL and intralesional corticosteroid injection offer comparable overall efficacy in nail psoriasis, but differ in their site-specific effects, response dynamics, and clinical applicability. Rather than viewing one modality as superior, they should be considered complementary options, with selection tailored to the dominant pathological features and patient-specific factors. [62]

Safety, Pain, and Tolerability

When comparing pulsed dye laser (PDL) and intralesional corticosteroid injection for nail psoriasis, safety and tolerability are among the most clinically decisive factors, because both modalities may offer comparable efficacy in selected patients, yet they differ substantially in procedural burden and adverse-effect profile. In general, intralesional steroid injection is more invasive, more painful, and more operator-dependent, whereas PDL is less invasive, better tolerated, and associated mainly with transient local reactions rather than structural damage to the nail unit. These differences often influence real-world treatment selection as much as efficacy itself. [63]

Pain is the most important comparative disadvantage of intralesional corticosteroid injection. The nail unit is highly innervated, and injection into the proximal nail fold, matrix region, or nail bed can be markedly painful even when performed with a fine needle. Repeated sessions, treatment of multiple nails, and deeper matrix targeting further increase discomfort. In many reports, pain is substantial enough to require digital nerve block, topical anesthetic, cooling, distraction techniques, or modified delivery systems such as jet injectors. This is in clear contrast to PDL, where discomfort is usually described as mild to moderate and transient, often resembling a snapping sensation against the nail or periungual skin. [64]

This difference in pain burden has important implications for adherence. Intralesional steroid injection may be clinically effective, but patient willingness to return for repeated monthly sessions can be limited, especially when several nails are affected or when prior treatment sessions were poorly tolerated. In pragmatic clinical studies, discontinuation of steroid therapy due to pain has been documented, underscoring that tolerability is not a minor issue but a central limitation of this modality. By comparison, PDL is generally better accepted, particularly in patients with low pain tolerance, anxiety regarding injections, or a need to treat multiple nails in one visit. [65]

The nature of adverse effects also differs significantly between the two treatments. Intralesional corticosteroids carry a risk of structural and potentially lasting local complications, particularly when injection depth, concentration, or frequency are not optimal. Reported adverse effects include proximal nail fold atrophy, hypopigmentation, telangiectasia, subungual hematoma, nail plate thinning, Beau lines, and matrix injury that may lead to persistent dystrophy. Because the treatment is delivered directly



into or near the matrix, a technical error can produce unwanted tissue damage in the very structure responsible for nail plate formation. This makes safety highly dependent on operator experience. [66] PDL, in contrast, has a more favorable procedural safety profile. The most common adverse effects are transient purpura, erythema, edema, pinpoint crusting, or mild post-treatment discomfort. These reactions are usually self-limited and resolve without permanent sequelae. Importantly, published studies generally do not report the same degree of nail matrix damage, atrophy, or permanent dystrophic change seen with invasive injections. Thus, although PDL is not completely free of side effects, its complications are usually reversible and cosmetically less concerning. [67]

Another useful comparative point is cumulative treatment burden. Intralesional steroid injection may be manageable when only one or two nails are affected, but it becomes progressively less practical as the number of involved nails increases. Treating many nails in a single session increases total pain exposure, procedure time, and the likelihood that the patient will decline continuation. PDL is better suited to multi-nail disease because multiple nails can be treated in one sitting without a proportional increase in procedural intolerance. Therefore, even when efficacy is similar, PDL may be more feasible in extensive nail involvement simply because patients are more likely to complete the full course. [68]

Tolerability must also be interpreted in relation to the dominant disease site. For matrix-predominant nail psoriasis, intralesional steroids may still be chosen despite pain because they provide direct access to the pathology and may yield stronger improvement in pitting and matrix dystrophy. In such cases, clinicians may accept lower tolerability in exchange for higher site-specific effectiveness. However, when nail bed signs predominate, PDL often offers a more attractive balance, combining meaningful clinical improvement with lower discomfort and fewer procedure-related complications. This makes the comparison not only one of adverse events, but of whether the expected benefit justifies the procedural burden for a given nail phenotype. [69]

From a practical standpoint, the safety advantage of PDL must be balanced against logistical issues such as device availability, cost, and need for repeated visits. Nevertheless, in purely comparative tolerability terms, PDL is generally superior. Intralesional steroid injection remains valuable, especially in selected patients with limited matrix disease and access to an experienced clinician, but its invasive nature and greater risk of painful and structural local complications reduce its acceptability. Accordingly, if efficacy is judged to be broadly comparable, the better pain profile and safer local tolerability of PDL may tip the decision in its favor for many patients in routine dermatologic practice. [70]

Practical Considerations in Clinical Decision-Making

In routine clinical practice, the selection between pulsed dye laser (PDL) and intralesional corticosteroid injection is primarily guided by the predominant pattern of nail involvement rather than overall efficacy alone. Nail psoriasis is heterogeneous, and distinguishing between matrix-dominant and nail bed-dominant disease is essential. Intralesional corticosteroids are generally more suitable for matrix involvement, where direct delivery of the drug can effectively target inflammation responsible for pitting and nail plate dystrophy. In contrast, PDL is more appropriate for nail bed disease, where vascular changes play a central role and laser therapy can directly address angiogenesis and inflammation. [71]

Patient-related factors, particularly tolerance to procedures, play a major role in decision-making. Intralesional steroid injections are often associated with significant pain, which may limit patient acceptance, especially when multiple nails require treatment or repeated sessions are needed. This can negatively affect adherence and overall treatment success. On the other hand, PDL is typically well tolerated, with only mild discomfort during sessions, making it a more acceptable option for patients with low pain tolerance or anxiety toward invasive procedures. [72]

The extent of nail involvement is another important consideration. Intralesional injections are more practical when a limited number of nails are affected, as the cumulative discomfort and procedure time increase with each additional nail. In contrast, PDL allows treatment of multiple nails in a single session without a proportional increase in pain or complexity. This makes PDL particularly advantageous in patients with widespread nail involvement, where repeated injections would be less feasible or poorly tolerated. [73]



Resource availability and cost also influence treatment choice. Intralesional corticosteroid injection is relatively inexpensive and widely accessible in most dermatology settings, requiring minimal equipment. In comparison, PDL requires specialized laser devices and trained operators, which may limit its availability in certain regions or healthcare systems. Additionally, the cost of multiple laser sessions may be a barrier for some patients, despite its favorable tolerability profile. [74]

The timeline of response and treatment expectations should also be discussed with patients. Intralesional steroids may produce faster improvement in certain nail features, particularly matrix-related changes, which can be advantageous when rapid results are desired. PDL, however, typically requires multiple sessions over several weeks or months to achieve optimal outcomes, reflecting the gradual nature of vascular remodeling and nail growth. Despite this, its non-invasive nature may improve long-term adherence and patient satisfaction. [75]

Overall, the choice between PDL and intralesional corticosteroid injection should be individualized based on disease characteristics, patient preference, and practical considerations. Rather than viewing the two modalities as competing options, they can be considered complementary, with each offering advantages in specific clinical scenarios. A tailored approach that aligns treatment selection with disease phenotype and patient tolerance provides the most effective and realistic strategy in managing nail psoriasis. [76]

Conclusion

Both pulsed dye laser and intralesional corticosteroid injection represent effective localized treatment options for nail psoriasis, with broadly comparable overall efficacy but distinct profiles in terms of mechanism, tolerability, and clinical applicability. Intralesional corticosteroids remain particularly effective for matrix-dominant disease and may offer faster targeted improvement, but their use is limited by procedural pain and the risk of local adverse effects. In contrast, pulsed dye laser provides a non-invasive alternative with better tolerability and safety, showing particular strength in nail bed involvement and in patients requiring treatment of multiple nails.

In clinical practice, the choice between these modalities should be individualized based on disease phenotype, patient preference, and available resources. Rather than a direct substitution, they should be viewed as complementary approaches, each suited to specific clinical scenarios. Optimizing outcomes in nail psoriasis requires aligning treatment selection with the underlying pathology and patient-specific factors, while future research should aim to refine comparative protocols and establish standardized treatment strategies.

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