Pulsed Dye Laser for the Treatment of Nail Psoriasis

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Practice Points

- The pulsed dye laser may be clinically useful in treating lesions caused by nail psoriasis.
- Patients interested in pulsed dye laser treatment of nail psoriasis should be advised about the risk for associated side effects.

Psoriasis can involve the skin, joints, and nails, either alone or in combination. Psoriasis of the nails can involve both the nail bed and nail matrix. The treatment of nail psoriasis largely depends on the severity of symptoms. The pulsed dye laser (PDL) recently has demonstrated efficacy in treating resistant plaque-type psoriasis and has been suggested as an alternative to conventional therapies. We review 4 studies of PDL for nail psoriasis and discuss the findings in relation to treatment recommendations. Ultimately, a standardized regimen for the treatment of nail psoriasis remains elusive.

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Psoriasis is a chronic dermatologic disorder that affects millions of individuals worldwide. Its estimated prevalence in the United States is 2.1% to 2.6%, more commonly affecting white patients and those in the extremes of latitudes.[1] Psoriasis varies in presentation and can involve the skin, joints, and nails, either alone or in combination. Nail psoriasis affects up to 50% of patients with cutaneous psoriasis.[2] More than 50% of patients may report pain and embarrassment associated with their disease.[3,4] Although nail lesions rarely are the only presenting manifestation of psoriasis, they have a high lifetime incidence in psoriatic patients.[5]

Psoriasis, including nail manifestations, is an immunologic disease predominantly triggered by abnormal CD4 and CD8 T-cell expansion.[6] This activation eventually leads to the infiltration of inflammatory cells into the epidermis, resulting in the characteristic cutaneous lesions found in psoriasis.[7,8] The maintenance of these lesions requires an expanded superficial vascular network, which begins prior to the onset of lesion formation[9]; thus the early phase of psoriasis often features blood vessel elongation and increased tortuosity.[10]

Psoriasis of the nails can involve both the nail bed and nail matrix (Figure 1). Nail pitting frequently is seen from nail matrix dystrophy, while nail bed disease can manifest as onycholysis and/or subungual hyperkeratosis. Nail involvement is more commonly found in patients with psoriatic arthropathy than in those with uncomplicated psoriasis.[11] There is an association between distal interphalangeal arthritis and disease of the adjoining nail.[12] The hypothesized pathogenesis is that the enthuses that attach the bone of the distal phalanx to the nail may assist in carrying and spreading inflammation from nail to bone via fat tissue.[13] The presentation of nail disease essentially is the same in both situations (with and without psoriatic arthropathy); however, Maejima et al[11] found that nail bed lesions, including nail bed hyperkeratosis, nail plate crumbling, and onycholysis, are

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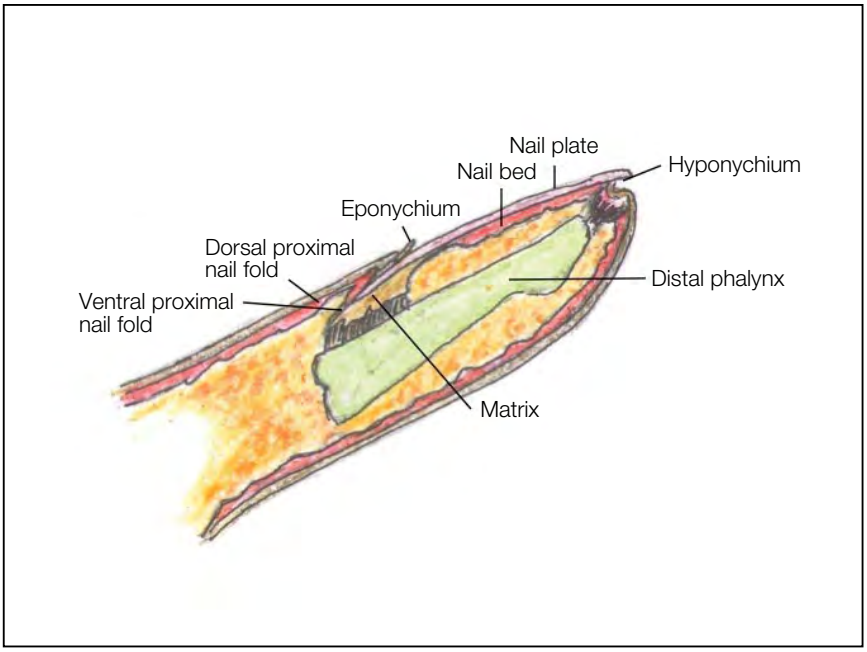

Figure 1. Cross-sectional anatomy of the fingernail unit.

Figure 2. Nail matrix psoriasis demonstrating pitting and onycholysis. Photograph courtesy of Antonella Tosti, MD, Miami, Florida.

more prevalent in patients with psoriatic arthropathy compared to cases of uncomplicated psoriasis. The sole presence of nail disease increases the likelihood of developing psoriatic arthropathy.[14] Although nail involvement is more common in patients with psoriatic arthropathy, it does not indicate the severity of systemic psoriatic involvement.[14]

The clinical findings of nail psoriasis include pitting (the most common manifestation), nail bed discoloration, onycholysis (Figure 2), subungual hyperkeratosis, abnormalities of the nail plate, and splinter hemorrhages.[15]

The treatment of nail psoriasis largely depends on the severity of symptoms. Local or topical therapies along with UV therapy should be attempted initially; however, the efficacy of these methods is limited, as penetration through the nail plate and nail matrix is difficult. Systemic therapy may be needed in patients

with severe disease or if topical treatment fails.[16] Systemic treatment is not recommended for patients with psoriasis limited to the nails.[17] Biologic agents also have been deemed effective in the treatment of nail disease. Overall, however, studies conducted to determine the efficacy of these treatments have been highly variable and inconsistent. The pulsed dye laser (PDL) recently has been demonstrated as efficacious in treating resistant plaque-type psoriasis and has been suggested as an alternative to conventional therapies, as we discuss in this review.

Pulsed Dye Laser

Pulsed dye lasers commonly are used in dermatology to treat cutaneous vascular lesions, including hemangiomas, telangiectases, and port-wine stains. Use of PDL is based on the concept of selective photothermolysis, which destroys targeted structures via chromophores by monochrome light without affecting the surrounding tissue.[18] The most frequently chosen wavelengths for PDL therapeutic use are 585 and 595 nm,[19] which can effectively reach the nail bed through the nail plate.[20]

The PDL has been used in the treatment of psoriasis,[21] primarily because of the highly vascular nature of psoriatic lesions.[22] Waves from the PDL are well absorbed by oxyhemoglobin, a conduit for microvessel damage and destruction.[23] Aside from the destruction of blood vessels, PDL therapy has been shown to decrease the number of cytotoxic T cells in the epidermis and helper T cells in the dermis.[24] Pulsed dye laser therapy has been investigated in the treatment of other forms of psoriasis, most recently in nail psoriasis.[21] The Table reviews studies on PDL therapy for nail psoriasis.

PDL Versus Photodynamic Therapy

Fernández-Guarino et al[25] conducted a study that evaluated and compared the efficacy of PDL and photodynamic therapy (PDT) for the treatment of nail psoriasis. The PDL was used as the light source in PDT. The secondary objective of the study was to compare the treatment response on the nail matrix versus the nail bed. All of the patients treated with either PDL or PDT demonstrated a decrease in their global nail psoriasis severity index (NAPSI) scores, with an average decrease of 9.57 and 9.14 points, respectively.[25] (The NAPSI is an objective numeric grading tool used to evaluate disease severity. To obtain a patient's NAPSI score, the nail is divided into 4 quadrants; each quadrant then is evaluated based on the presence or absence of signs of nail bed and/or nail matrix disease and is given a score. The sum of the individual scores for each quadrant is the patient's NAPSI score.[2]) This study revealed no statistically significant difference between the use of PDL and PDT in the treatment of nail psoriasis based on NAPSI scores, and a decrease in NAPSI scores was associated with both treatments for both nail bed and nail matrix involvement.[25]

Photodynamic therapy in this study was administered with topical methylaminolevulinic acid.[25] The investigators concluded that topical methylaminolevulinic acid likely did not contribute to the improvement of nail psoriasis; the results, therefore, could be attributed to PDL alone. The only reported adverse reaction to treatment was pain on application of PDT; however, the pain was not severe enough to discontinue treatment. The majority of participants continued to undergo PDL sessions after the study concluded. Although the study was limited by the lack of a placebo group for control, the investigators concluded that PDL is efficacious in improving all clinical parameters in nail psoriasis.[25]

PDL in the Treatment of Nail Psoriasis

In a study by Oram et al,[20] researchers selected 5 patients with nail involvement refractory to topical treatments to receive PDL. Rhodamine was the active medium for the PDL, which emitted yellow light at a wavelength of 595 nm. Before application of PDL, the mean (standard deviation [SD]) NAPSI score was 14.6 (2.5) for nail bed lesions and 7.0 (1.4) for nail matrix lesions. After PDL treatment, the mean (SD) NAPSI scores for nail bed and nail matrix lesions decreased to 0.8 (0.5) and 2.2 (0.7), respectively. The researchers found that onycholysis and subungual hyperkeratosis of the nail bed, which caused most patient discomfort, responded best to PDL, while nail pitting was most resistant to treatment. The main side effects appeared to be pain, which typically lasted 24 hours, and mild purpura. Purpura resolved after 3 to 7 days in the treated nails. Although nail pitting was the most persistent finding, the researchers concluded that clearance of pitting may be observed months after laser irradiation, as the complete growth of nail plate from the matrix to the hyponychium generally takes approximately 6 months. Limitations of this study include the lack of blinded investigators and a small sample size.[20]

Effect of Different Pulse Durations in Treatment of Nail Psoriasis

Treewittayapoom et al[26] sought to determine the optimal pulse duration for treating nail psoriasis with PDL by comparing the efficacy of short (0.45 millisecond) versus long (6 millisecond) pulse durations. Patients with nail lesions were randomized into 2 groups based on which hand (left or right) was affected. Treatment on 1 hand included a 7-mm spot

PDL for Nail Psoriasis

Reference (Year)	Objective	Patients	Results	Level of Evidence[a]
Fernández-Guarino et al[25] (2009)	Compare the efficacy of PDT and PDL in the treatment of nail psoriasis; compare treatment responses of lesions of the nail matrix versus the nail bed	14 patients with clinically significant nail psoriasis (61 nails treated with PDT; 60 nails treated with PDL)	Reduction in NAPSI scores in both nail matrix and nail bed in both treatment groups; no statistical differences were noted between PDT and PDL	Level II
Oram et al[20] (2010)	Evaluate the effect of PDL in treating nail psoriasis	5 patients with mild to moderate plaque psoriasis with refractory nail involvement	Marked improvement in NAPSI scores following treatment; nail bed lesions, particularly onycholysis and subungual hyperkeratosis, responded best to PDL	Level II
Treewittayapoom et al[26] (2012)	Compare the efficacy and safety of different pulse widths to determine the optimal pulse duration of PDL for the treatment of nail psoriasis	20 patients with psoriasis of the bilateral fingernails	6 months after first treatment, there was a marked reduction in overall NAPSI, nail matrix NAPSI, and nail bed NAPSI scores from baseline in both groups; no significant difference was found between the 2 pulse duration groups; side effects were mild, including petechiae and hyperpigmentation	Level I
Huang et al[27] (2013)	Evaluate the efficacy and safety of PDL with a topical retinoid in treating nail psoriasis	25 patients with recalcitrant psoriasis of the bilateral fingernails	Marked reduction in mean NAPSI score from baseline to 6 months in the experimental group compared to the control group; notably higher percentage of patients in the experimental group showed ≥75% improvement at 6 months versus the control group [physician global assessment]; patient global assessment scores were higher in experimental group versus control group	Level II

Abbreviations: PDL, pulsed dye laser; PDT, photodynamic therapy; NAPSI, nail psoriasis severity index.
[a]Level I is a randomized controlled study; level II is a prospective comparative study.

size, 0.45-millisecond pulse duration, and a fluence of 6 J/cm^2; the other hand was treated with a 7-mm spot size, 6-millisecond pulse duration, and a fluence of 9 J/cm^2. The treatment period was 6 months with 1 session per month. The mean total and mean nail matrix NAPSI scores for both treatment groups were significantly reduced ($P<.005$), observed as early as the first month of treatment; however, there was no significant difference in outcomes in either group. The adverse effects of treatment noted in this study were petechiae and hyperpigmentation, both mild and transient. A higher level of pain was statistically significant in the longer pulse duration group compared to the shorter pulse duration group ($P<.05$), though there was no need for analgesics or other remedies. Ultimately, there were no significant differences in the adverse effects between the 2 groups.[26]

Improvement in nail bed NAPSI scores was much slower than improvements in nail matrix scores, with observed improvement not seen until the third month of treatment.[26] This finding differed from the results of the Oram et al[20] study, which demonstrated that nail bed lesions, particularly onycholysis and subungual hyperkeratosis, responded best to PDL treatment. This study found that the mean total NAPSI scores, mean nail matrix NAPSI scores, and mean nail bed NAPSI scores increased significantly between the third and fifth months of treatment ($P<.05$), suggesting that the maximum benefit of PDL in nail psoriasis may be obtained after 3 to 4 treatments; however, the study only looked at mild to moderate severity nail psoriasis, and the investigators concluded that a longer treatment period may be required in patients with more severe disease.[26]

The majority of the patients in this study (50% [10/20]) maintained sustainable improvement and had no disease recurrence after a 15-month follow-up period.[26] Improvement lasted 3 to 6 months in 35% (7/20) of patients with eventual recurrence. The remaining 15% (3/20) of patients showed no improvement and did not respond to treatment.[26]

PDL Plus Topical Retinoid

Most recently, Huang et al[27] conducted a controlled study to evaluate the efficacy and safety of PDL in combination with tazarotene cream 0.1% in treating patients with nail psoriasis. Distinct from the previously reviewed studies, this investigation included both patients with severe psoriasis who were receiving systemic therapy as well as those with mild psoriasis who were not receiving systemic therapy or had stopped therapy for at least 8 weeks. All fingernails on one hand (the experimental hand) were treated with a 595-nm PDL (pulse duration, 1.5 millisecond; beam diameter, 7 mm; fluence, 9 J/cm^2) once monthly in conjunction with tazarotene cream 0.1% for a total of 6 months (experimental treatment). The other hand was treated with tazarotene cream 0.1% only (control treatment). On fingernails that received the laser treatment, proximal and lateral nail folds were treated with contiguous layers of spots, with 10% overlapping.[27]

Nineteen of 25 enrolled patients completed the 6-month study. The mean (SD) modified NAPSI score at baseline was 36 (29.8), with no significant difference between the experimental and control groups.[27] The investigators found that in all patients the mean decrease in nail matrix modified NAPSI scores (from baseline to 6 months posttreatment) was significantly greater in the experimental versus the control group ($P=.026$). Unlike the previously mentioned study findings, however, the mean decrease in nail bed modified NAPSI scores over the same time period were not significantly different between the experimental and control groups. According to the physician global assessment, a significantly higher number of patients receiving experimental treatment demonstrated 75% or greater improvement after 6 months of treatment compared to the control group ($P=.045$). Interestingly, although the patient global assessment scores also were significantly higher in the experimental versus control group ($P<.001$), only 47% (9/19) of patients undergoing the experimental treatment reported improvement in their perceived fingernail cosmesis. The study also concluded that the effects of treatment with topical tazarotene in combination with PDL were not synergistic.[27]

Unfortunately, this recent evaluation was not a randomized study, as patients were allowed to choose which hand received treatment.[27] The small sample size of patients also was a limitation of this study. The investigators concluded that PDL is best used for patients with nail psoriasis with, at most, mild cutaneous involvement.[27]

Comment

These studies suggest that PDL may be clinically useful in treating lesions caused by nail psoriasis. The 595-nm laser with 6- and 0.45-millisecond pulse durations proved to be effective in treating both nail matrix and nail bed psoriasis.[26]

Substantial improvement was noted in psoriatic lesions of the nail matrix following treatment with PDL in all 4 studies reviewed here,[20,25-27] while nail bed lesions improved in 3 of 4 studies.[20,25,26] Huang et al[27] found no significant difference in the degree of improvement of nail bed psoriasis with PDL treatment versus control; the investigators speculated that the difference may be due in part to the nail locations treated. Fernández-Guarino et al[25]

and Oram et al[20] treated both the nail plate and proximal nail fold overlying the nail matrix and bed, and Treewittayapoom et al[26] treated the lunula and proximal nail fold. However, Huang et al[27] restricted PDL treatment to the proximal and lateral nail folds, which may explain why no improvement was observed in the nail bed lesions. This difference in treatment site also may explain the distinction seen in rate of response to PDL. Oram et al[20] found that nail bed lesions, particularly onycholysis and subungual hyperkeratosis, responded best to PDL treatment, whereas Treewittayapoom et al[26] saw a rapid and robust nail matrix response with later, more gradual nail bed improvement.

The consensus regarding optimal treatment time with PDL was 3 to 6 months. All 4 studies reported early responses to PDL treatment within the first 3 months. Fernández-Guarino et al[25] and Treewittayapoom et al[26] both demonstrated maximum benefit, with the lowest NAPSI scores, in treating nail bed and nail matrix lesions for 6 months. Huang et al[27] also noted substantial improvement in nail matrix lesions after 6 months of treatment. Patients in the Oram et al[20] study were treated for only 3 months and saw marked clinical improvement; however, the investigators predicted that the resistant pitting lesions would have healed further with 6 months of treatment.

Finally, PDL was reported to be safe and relatively well tolerated by patients in all 4 studies.[20,25-27] Reported side effects also were similar, including pain, purpura, and hyperpigmentation; increased pain was seen with longer pulse durations. Although these adverse effects were transient and did not appear to discourage patients from receiving treatment, further studies are needed to corroborate these conclusions regarding the safety of PDL treatment. For now, patients interested in PDL for nail psoriasis should be advised that these risks can be serious.

Conclusion

Ultimately, a standardized regimen for the treatment of nail psoriasis remains elusive. Despite the promising findings of the 4 studies reviewed here, larger randomized controlled trials are still needed to validate the utility of PDL in the treatment of nail psoriasis.

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