

Cynergy Multiplex Treatment of Port-Wine Stains

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Background and Objectives

Port-wine stains (PWS) are congenital malformations of vessels located in the papillary and reticular dermis. They present at birth and, in contrast to hemangiomas which usually undergo spontaneous resolution, they persist without a tendency to resolve, typically darkening to a deep red and becoming thicker and more nodular over time. These tendencies, as well as the high rate of self-esteem issues and the inherent increased risk of bleeding and skeletal anomalies, provide compelling reasons to recommend treatment of these lesions.

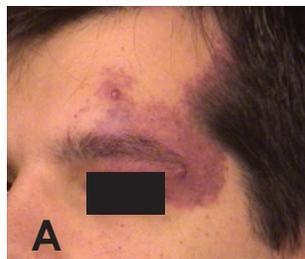
The objective of PWS laser treatment is to maximize thermal damage to targeted blood vessels while preventing injury to the normal adjacent epidermis and dermis. The pulsed dye laser (PDL) has long been considered the gold standard treatment for PWS due to its safety profile in children and adults and its efficacy across a wide range of skin phototypes.^{1,2} Because PWS are often associated with soft tissue hypertrophy with advancing age, older port-wine stains are particularly difficult to treat due to the depth of the vascular lesion.³ In addition, lesions that are located in more difficult treatment locations, either because of skin thickness (eg, back, mid-cheek) or inherently slow healing responses (eg, extremities), may be recalcitrant to treatment.⁴ Lastly, PWS lesions may become “hardened” to subsequent therapy after several PDL treatments either due to advancing lesional age (as described above) and/or thickening of residual blood vessels after repetitive laser impacts.

Over the years, modifications to the original PDL system have been made in order to address these

difficulties in treatment. The wavelength was adjusted from 577/585 nm to 595 nm in order for slightly deeper dermal penetration without sacrificing vascular specificity.^{5,6} The pulse duration was also lengthened (0.45 ms to upwards of 40 ms) to optimize heating of larger caliber blood vessels.⁷ Concomitant skin cooling technology permitted application of higher fluences to increase clinical efficacy without epidermal disruption.^{8,9} Changes in technique, including pulse stacking wherein three or four pulses are placed on top of each other at rapid repetition rates, were additionally shown to enhance clinical results without significantly increasing adverse effects.¹⁰



Early PWS - 1-year-old boy was born with pink patches on his brow and temple (A). PDL treatment was initiated at 4.5 J/cm² (0.5 ms, 10 mm spot). Five additional PDL treatments were delivered at 2 month intervals (4.5-6 J/cm, 0.5-6 ms, 10 mm spot) with marked lesional fading. (B) Immediately after each treatment, the skin appeared mildly erythematous and edematous. No purpura, vesiculation, pigmentary abnormalities or scarring were observed.



Mature PWS - A 34-year-old man presented with an advanced PWS on the brow and temple. (A) No prior treatment had been obtained. Multiplex treatment was delivered with sequential 10 mm pulses of the PDL (6-7.5 J/cm², 6 ms pulse duration) and Nd:YAG (30-35 J/cm², 10-15 ms) at bi-monthly intervals. Immediately after each treatment, the lesion appeared slightly darker and swollen. No other side effects were noted. Progressive lesional lightening was noted after each of the 10 laser treatments. (B)



Recalcitrant PWS - A 6-year-old boy with a PWS on his cheek, nose, and upper lip exhibited limited lesional fading after numerous (>10) PDL laser treatments which had been initiated in infancy. (A- after PDL rx) After two sessions with the Multiplex system (PDL: 7.5-8.5 J/cm², 6-10ms; Nd:YAG: 30-35 J/cm², 10-15 ms), marked lesional fading was noted. (B)



Nodular PWS - A 78-year-old man presented with an advanced, nodular PWS involving his right cheek. (A) No prior treatments had been obtained. Multiplex treatments were delivered with sequential PDL (7.5-9 J/cm², 6-10 ms) and Nd:YAG (30-35 J/cm², 10-15 ms) laser irradiation at bi-monthly time intervals. Lesional fading and reduction of soft tissue hypertrophy was seen after a series of 10 laser sessions. (B)



PWS in Pigmented Skin - A 43-year-old woman with skin phototype V presented with a facial PWS. (A) Treatment was initiated with 1064 nm Nd:YAG laser (35 J/cm², 10-15 ms pulse) every 2-3 months. Immediately after laser irradiation, the skin remained intact with minimal erythema and swelling. No crusting, vesiculation, pigmentary alteration or fibrosis was experienced. After 8 treatment sessions, fading of the vascular lesion was evident without loss of epidermal pigmentation. (B)

Other lasers have also been applied successfully for PWS treatment, including the 1064 nm neodymium:yttrium-aluminum-garnet (Nd:YAG) laser system.¹¹ The ratio of melanin to blood absorption is similar at 585 and 1064 nm, whereas the absolute values of absorption and scattering coefficients are considerably lower at 1064 nm as compared

with 585 nm. Because many PWS lesions extend 3-to-5 mm into the dermis and the PDL is effective to a depth of only 1-2 mm, the longer wavelength of the Nd:YAG is better suited for treatment of deeper vessels.

A novel technology (Cynergy, Cynosure, Inc., Westford, MA) which combines 595 nm PDL and 1064 nm Nd:YAG lasers has been developed to address several of the issues outlined above. The Multiplex feature of the Cynergy device delivers sequential, timed pulses from the two laser heads through a single fiber handpiece. The application of 595 nm light followed by the 1064 nm wavelength takes advantage of a chromic shift in blood when heated above 62° C: the oxyhemoglobin absorption coefficient peaks at 595 nm whereas the methemoglobin absorption coefficient aligns with 1064 nm. The combination laser is best used for advanced (darker, thicker, nodular) and/or recalcitrant PWS, whereas the PDL portion of the system can be used alone for superficial/early (pink) PWS and the Nd:YAG laser can be used alone to provide more effective treatment of PWS in patients with darker skin tones.

References

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