

Effectiveness of Dual Sequential Wavelength Laser in the Treatment of Portwine Stains – A Retrospective Study

Abstract

Background: Port Wine Stain (PWS) is only partially and superficially treated with the Pulsed dye laser (PDL) because of its limited depth of penetration. The 1064-nm long pulsed Nd:YAG laser has greater depth of penetration and is used to treat deeper vessels. The dual sequential wavelength laser (DSWL) which combines PDL/Nd:YAG (595/1064 nm) can be more effective for the treatment of deeper, nodular portwine stains due to its synergistic effect. The purpose of this study is to evaluate the efficacy and safety of DSWL in the treatment of portwine stains after five treatment sessions. **Materials and Methods:** A total of 11 patients with PWS lesions on the head and neck, who were treated with DSWL for at least five sittings at monthly interval were included in this study. The assessment of the therapeutic response and grading of improvement was done with a scale of 0 to 4 by comparing the photographs taken before treatment and after 5 sittings of laser treatment. **Results:** Out of the 11 patients, 5 patients (45.45%) had more than 70% improvement. Six out of eleven patients (54.54%) had 40 to 70% improvement at the end of five sittings with no adverse effects including purpura. **Conclusion:** Dual Sequential Wavelength Laser is a good modality of treatment for portwine stains. It has enhanced penetration and effective clearance of thicker, nodular, recalcitrant lesions of PWS. DSWL is safe and efficacious and it can be recommended as a therapeutic modality for portwine stains.

Keywords: Dual sequential wavelength laser Nd:YAG laser, PDL, portwine stains, vascular lasers

Introduction

Pulsed dye laser (PDL) is the “gold standard” for treating portwine stains (PWS).^[1] PDL is used for many years to treat vascular lesions. It destroys the target tissues by the principle of selective photothermolysis.^[2] Nearly 25–50% of the lesions treated with PDL alone do not demonstrate a significant improvement even after many sessions of treatment. The 1064 nm-long pulsed Nd:YAG laser has greater depth of penetration of upto 5 to 6 mm and greater affinity for deeper large vessels.^[3] Vascular lesions of varying size, density, color, flow and depth may not respond to either PDL or Nd:YAG alone.^[4] The dual sequential wavelength laser (DSWL) which combines PDL/Nd:YAG with 595/1064 nm has been proposed as an alternative treatment for PWS. DSWL is effective for the treatment of portwine stains. It produces two widely separated laser wavelengths in a single device^[5] and at a lower fluence, it gives good therapeutic response with lesser side effects.^[6]

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Materials and Methods

This is a retrospective study conducted in our department of dermatology after getting approval from our institutional ethics committee. Eleven patients with PWS lesions on the head and neck, who were treated with DSWL (Cynergy system, Cynosure Corp, Westford, MA, USA) for at least five sittings at monthly interval were included in this study.

All the patients had been treated with a fluence ranging from 4 to 10 J/cm² and pulse duration between 0.5 and 40 ms for PDL and a fluence ranging from 20 to 50 J/cm² with pulse duration between 15 and 40 ms for Nd:YAG. The spot size of 7 or 10 mm were used with inter-pulse delay of 1 second for sufficient cooling. The air cooling device (Cynosure smart cool, USA) was attached to the laser hand piece for epidermal cooling. The assessment of the therapeutic response and grading of improvement was done with a scale of 0 to 4 by comparing the photographs taken before treatment and after five sittings of

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laser treatment. Grade 0 is less than 20% improvement, grade 1 is 21 to 40% improvement, grade 2 is 41 to 60% improvement, grade 3 is 61 to 80% improvement, grade 4 is more than 80% of improvement.

Results

Of the 11 patients, 8 were females and 3 were male patients with age groups ranging from 18 to 44 years. One patient had lesions over the neck, 10 patients had facial lesions [Figure 1a]. The improvement of lesions after five laser sittings is shown in Table 1. Out of the 11 patients, 5 patients (45.45%) had more than 70% improvement, i.e., 1 patient had 90% improvement [Figure 1b], 2 patients had 80% improvement, 2 patients had 70% improvement. Totally, 6 out of 11 patients (54.54%) had 40–70% improvement i.e., 4 patients had 50% improvement and 2 patients had 40% improvement.

Out of the 11 patients, seven patients had flat reddish lesions and four patients had thick, elevated lesions of PWS over face [Figure 2a] and neck. Of the four patients who had thick, elevated lesions, 1 patient had 80% improvement [Figure 2b], 1 patient had 70% improvement, 2 patients had 50% improvement. One patient who had thick nodular lesions over the neck [Figure 3a] had 70% improvement [Figure 3b] after 5 sittings of laser treatment at monthly intervals. No adverse effects were recorded including purpura after DSWL treatment.

Discussion

Portwine stains (PWS) present as light pink macules due to progressive vessel ectasia and can progress into dark purple lesions. PWS are usually located in the papillary and reticular dermis. If hypertrophy of soft tissues occurs, it can become thicker and more nodular over a period of time. Various modalities of treatment are available for portwine stains, including Pulse Dye Laser, Nd:YAG lasers and Intense Pulsed Light (IPL). Several vascular lasers like argon, tunable dye, copper vapor, krypton lasers, which were also used in the past with the risk of dyschromia and scarring.^[7]

DSWL works under the principle of selective photothermolysis. It is the process by which a target tissue absorbs photons, becoming heated and destroyed totally, while structures surrounding it are relatively spared. In case of PWS, the desired targets are 10–500 µm dilated capillaries and postcapillary venules in the superficial and deep dermis.^[8] PDL has shallow depth of penetration and hence it is not effective for treating deeper, nodular lesions of PWS. Over the years, modifications to the original PDL system have been made in order to overcome these disadvantages. Usually PWS lesions extend 3 to 5 mm into the dermis and the PDL is effective only up to

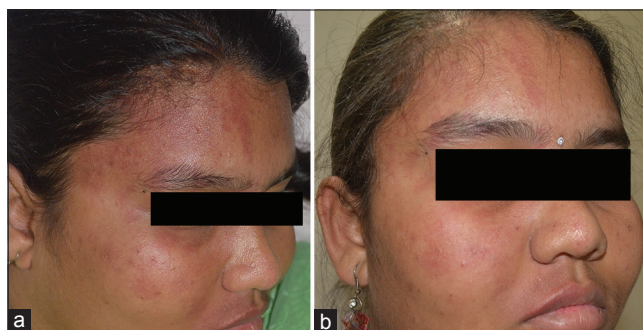


Figure 1: PWS lesions over the right half of face. (a) Before treatment. (b) After five sessions of treatment with DSWL at monthly intervals, she had 90% improvement

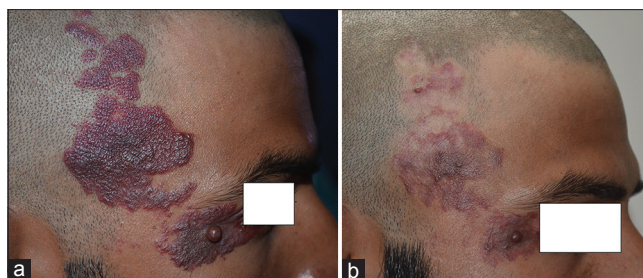


Figure 2: PWS lesions over the right side of scalp and face. (a) Before treatment. (b) After five sessions of treatment with DSWL at monthly intervals, he had 80% improvement



Figure 3: PWS lesions over the right side of neck. (a) Before treatment. (b) After five sessions of treatment with DSWL at monthly intervals, she had 70% improvement

Table 1: Percentage of improvement after 5 sittings

Age/Sex	Site of the lesion	Improvement (%)
23 yrs/M	Right side of the scalp and face	80
18 yrs/F	Right side of the face	90
34 yrs/M	Left side of the face	40
20 yrs/F	Right side of the face	50
33 yrs/F	Right side of the forehead and upper eyelid	40
21 yrs/F	Left side of the cheek and upper lip	70
28 yrs/M	Left side of the face	50
18 yrs/F	Left side of the cheek and upper lip	50
22 yrs/F	Left side of the face	80
44 yrs/F	Left side of the face	50
42 yrs/F	Right side of the neck	70

2 mm depth. Deeper vessels that are not damaged fully with PDL therapy may recover in future. High energy is required to thermo-coagulate the deep vessels and hence, epidermis should be protected to minimize the damage to keratinocytes and melanocytes by means of epidermal cooling. Cooling is therefore an integral part of all vascular lasers.^[8]

DSWL is a new concept that sequentially emits two wavelengths from the same delivery fiber with a pre-selected delay between the two pulses. The PDL energy emits first, converts oxy-hemoglobin to met-hemoglobin. Met-hemoglobin has three times higher absorption co-efficient to Nd:YAG wavelength than oxy-hemoglobin. Pre-selected delay will allow the met-hemoglobin to penetrate deep into the blood vessels. Nd:YAG laser emits few milliseconds later following PDL, allows the reduction of treatment fluence and thereby reduces the adverse effects.^[1]

Usually PWS appears pink during infancy period, which becomes red during adulthood. Without treatment, PWS typically darkens as age increases and may develop nodular thickened lesions. Early treatment gives more optimal results in all patients. Much quicker results can be visualized when the laser treatment is begun at an earlier age.^[8]

Zoran Barcot *et al.* stated that, after PDL treatment nearly 65% of patients achieved between 50% and 90% lightening of their lesions and 15% achieved greater than 90% lightening with individual treatment sessions spaced 2 to 3 months apart; 8 to 10 serial treatments were needed to achieve significant lightening of the lesions.^[9] Tina Alster *et al.* proved that the use of dual 595/1,064-nm wavelength laser provided continued improvement of PWS that were previously recalcitrant to PDL therapy. Moderate clinical improvement was observed in 12 out of 25 subjects (48%), and mild improvement was observed in 13/25 subjects (52%). The total number of treatments ranged from 2 to 7 sessions. Side effects were limited to erythema, edema, and purpura. Rarely vesicle formation was observed, with no scarring or pigmentary changes.^[10]

Badawi *et al.* conducted a study with 20 patients of nodular and thick port wine stains, stated that the average improvement was 70% following 4 treatment sessions at 3–4 weeks interval.^[11] Barton *et al.* has demonstrated that the sequential application of lasers at 532- and 1,064-nm wavelength caused permanent vessel damage at which the two pulses individually had little or no effect.^[12]

Alster *et al.* stated that the DSWL is best used for darker, thicker, nodular, recalcitrant PWS, whereas the PDL can be used alone for superficial, early, pink lesions of PWS, and the Nd:YAG laser can be used alone in patients with darker skin tones. The frequency of laser treatments in the literature showed more variations, ranged between few

weeks to few months. Patients with dark skin types have increased risk for hypo or hyper-pigmentation, may benefit more from this DSWL technology.^[13]

Koster *et al.* demonstrated that studies show 50–90% overall clearance of PWS, with approximately 10% improvement per treatment session. Superior results had been observed with the DSWL approach when compared to PDL alone in PWS cases which was resistant to other treatment modalities.^[14] In this study, out of the 11 patients 5 patients (45.45%) had more than 70% improvement, 6 patients (54.54%) had 40–70% improvement at the end of 5 sittings and there was a progressive lesional lightening noted after each laser treatment in all patients without any adverse effects.

Conclusion

Dual sequential wavelength laser (DSWL) is a good modality of treatment for portwine stains. It has enhanced penetration and effective clearance of thicker, nodular, recalcitrant lesions of PWS. DSWL is safe and efficacious and it can be recommended as a therapeutic modality for portwine stains.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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