Case Report and Review of the Literature

Nd: YAG laser and intense pulsed light in the treatment of port wine stains: case report and review of the literature

ABSTRACT

Introduction: Port wine stains (PWS) are vascular malformations present at birth and, depending on their location, they can cause psychological changes in the patient. Studies on the treatment of PWS with intense pulsed light (IPL) and other types of lasers presented different responses. The aim of this study was to review the literature on the treatment options of PWS with light sources, demonstrating the success of IPL associated with Nd:YAG laser. Methods: A 14 years old female patient with PWS in the supralabial region was treated with the association of 1064- nm Nd:YAG laser and 560-nm IPL. She underwent eight treatment sessions with a mean interval of 30 days between each session. The study was conducted at the Célia Kalil Dermatology Clinic**. Results:** The port wine stains disappeared completely with a very low incidence of adverse events. Conclusion: The association of 560-nm IPL and 1064-nm Nd:YAG laser is an appropriate treatment for PWS.

Keywords: port wine stains, laser, IPL, treatment.

INTRODUCTION

Port wine stains (PWS) represent vascular malformations[1,2,3] seen in 0.3% of the population, affecting both genders equally, and they are characteristically present at birth.[6] Approximately 80% of PWS are found on the face or neck.[5,6,7,8,9] They are frequently unilateral and segmental, respecting the midline, and increase in the same proportion as the growth of the child. They do not show a tendency for spontaneous regression.[10] Microscopically, PWS consist of ectasic capillaries in the dermis without any indication of vascular proliferation.[10] A thorough medical history and physical examination are enough to differentiate PWS from other vascular malformations or hemangiomas[11] (Table 1).

The pathogenesis of PWS could be related with a deficit in neural perivascular control,[12] with the consequent progressive dilation of a previously normal vascular plexus. This would cause darkening and hypertrophy of the lesion with aging.[13]

Port wine stains become progressively darker, going from a pink color, during childhood, to a purplish color in adult life.[3,12] Initially, they can be macular, but with aging, especially after the fourth decade of life, they can become irregular, darkened, and with a nodular surface.[14] In some children, the area may become clearer with age, but total regression is unusual.[15]

Malignant changes are very rare.[16] Patients suffer, mainly, with aesthetic problems, especially with facial lesions.[17] During childhood, when PWS affect the first division of the trigeminal nerve, or are located in one of the extremities, or when a vascular malformation involves the spinal cord,[18] systemic syndromes, such as the Sturge-Weber, Klippel-Trenaunay-Weber, and Cobb's syndromes, respectively, should be investigated.[5]

Significant psychological and social difficulties have been associated with PWS and, in some cases, they require psychological treatment.[5] When PWS become thicker and darker, usually during the growth period, is the best moment to treat the lesions, which should be done as soon as possible.[11] Intense pulsed light (IPL) devices, lasers, such as pulsed dye (PDL), neodymium doped yttrium-aluminum-garnet (Nd:YAG), argon, potassium-titanyl-phosphate (KTTP), krypton,

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Table 1. Hemangiomas and Port wine Stains – differential diagnosis

	Present at birth	Growth proportional to the rest of the body	Spontaneous regression	Increase in venous pressure leads to an increase in the size of the lesion	Palpable pulse
Haemangiomass	No	Yes	Yes	No	Não
Vascular malformation	No	No	No	Yes - venous malformation No - arterial, arteriovenous, or lymphatic malformation	No - venous malformation Yes - arterial or arteriovenous malformation

Adapted from: Kim K.H, Rohrer T.E, Geronemus R.G. Vascular lesions. In: Goldberg D.J, Dover J.S. Laser and Lights, edit Murad-USA, 2005, cap.02, p:13.

ruby, copper vapor, and others have been used with some success (Table 2).

The development of techniques involving cooling of the epidermis greatly increased the safety and efficacy of those systems, but there are some cases resistant to treatment.[19,20]

OBJECTIVE

The aim of this study is to review of literature about therapeutic options using light sources in PWS, and report a well-succeeded treatment case of PWS utilizing a source of intense pulsed light (IPL) associated with laser Nd:YAG.

CASE REPORT

A 14-year old female patient, skin phototype II, sought treatment for a macular skin blemish present since birth, reddish in color, approximately 2 cm in diameter, located in the central region of the upper lip, supralabial area, and tip of the nose. Despite the lack of symptoms, the patient referred embarrassment and difficulty socializing since the lesion was not aesthetically pleasing. She denied any prior treatment (Figure 1).

METHODS

The patient underwent eight treatment sessions, with a mean interval of 30 days between treatments, of IPL associated with Nd:YAG laser (Figures 1 to 3). An IPLTM Quantum DL (Lumenis Ltd): Nd:YAG 1064 nm and IPL 560 nm was used. The infraorbital nerve was blocked with 2% lidocaine before each treatment. For the Nd:YAG laser, a fluence variation of 128 to 130 J/cm^2 was used, with adjustment of programs 1 and 2. In the same treatment session we performed the IPL treatment with a fluence of 25 to 30 J/cm^2 and program 1. The patient requested that the upper lip should not be treated.

RESULTS

Shortly after each treatment, the area developed transitory erythema and edema, which became less severe as the size of the lesion decreased. Small erosions and crusts developed in the supralabial region after a few days. After treatment with mupirocin cream, the patient remained with a small depressed scar, which became virtually invisible several months after the last treatment (Figures 2 and 3).

Table 2. Lasers used in the treatment of vascular lesions

Laser	Wave length	Pulse	Vantages/ Disadvantages
Argon	488 to 514 nm	50 msec to 0.3 sec	Low specificity
KTP	532 nm	1 to 50 msec	Does not cause purpura
Q-switched Nd:YAG (double frequency)	532 nm	20 msec	Low efficacy
Nd:YAG (double frequency)	532 nm	1 to 60 msec	Does not cause purpura
Diode	532 nm	1 to 100 msec	Does not cause purpura
Nd:YAG	1.064 nm	Up to 16 msec	Indicated for deeper and larger caliber vessels
Krypton	521, 532, 568 nm	Continuous	Effective for small caliber vessels
Copper vapor	578 nm	Continuous	Can produce scarring
FLPD	585 a 600 nm	450 to 1,500 µsec	Causes purpura
Vbeam	595 nm	1.5 to 40 msec	Does not cause purpura
High energy pulsed light	515 a 1.200 nm	1 to 25 msec	For small- and medium-caliber vessels

Adapted from: Osório N. Laser em lesões vasculares. In: Osório N, Torezan L.A.R. Laser em dermatologia. Conceitos básicos e aplicações, edit Roca - São Paulo Brasil, 2002, cap5,p:72.

DISCUSSION

Figure 1: Before treatment
Figure 2: After 4 treatment sessions
Figure 3: At the end of the treatment

Often PWS represent a psychological problem for the patient, besides causing vascular changes, especially in some specifics anatomical location.

By reviewing the literature, several therapeutic options using a light source were evaluated, but the lack of complete remission of the skin lesion is not uncommon.

Laser treatment of PWS is well-established. Despite more than 20 years of clinical experience, less than 25% of PWS show complete regression after several treatment sessions with PDL21 due to innate limitations of the equipment.[22,23] Possible side effects include epidermal lesions (crusts, erosion, and blisters), recurrence of the lesion, purpura, dyschromia, and the risk of scarring.[21] This has led to the study of new treatment options for vascular malformations using different light sources and associated equipment.

Approximately 20% of PWS, due to the presence of deep large-caliber vessels (more than 1.16 mm)[19,24] or with increased blood flow, are resistant to PDL. In this case, the energy generated by the equipment is not high enough to cause irreversible damage to those structures.

Since this was the first report in the literature using the IPLTM Quantum DL, we wanted to demonstrate the efficacy of treating PWS with IPL associated with Nd:YAG laser. With the proposed protocol, the area of PWS treated cleared with few side effects (transitory local hypopigmentation and subtle atrophy after healing of the crusts).

The use of the 1064-nm Nd:YAG laser in the treatment of vascular lesions has several theoretical advantages over the PDL. The Nd:YAG laser (wave length of 1064, pulse duration of up to 100 msec) is capable of causing coagulation to a depth of 5-6 mm and it has been used in the treatment of moderately deep vessels, vascular spiders (larger diameter), and reticular veins.[21,25] Besides, the absorption coefficient of melanin decreases as the wave length increases. At the 1064-nm wave length, the chance of post-treatment hyperpigmentation can be reduced significantly.[25,26,27,28] The addition of adequate epidermal cooling, which is characteristic of many of those devices, protects the skin, therefore preventing several adverse reactions, such as scar formation, pigmentation changes, blisters, crusts, and purpura).

Intense pulsed light has been effectively used in the treatment of vascular lesions,[29,30,31] including PWS.[32,33,34] With longer pulse duration (PD), IPL is capable of reaching deeper vessels slowly and, therefore, improve the efficacy of the treatment, decreasing the risk of post-treatment purpura and dyschromia.

The pulse duration of the IPL can be programmed between 0.5 and 88.5 milliseconds (depending on the equipment), and it should be lower than the thermal relaxation time of the target structure to avoid damaging surrounding structures.[35] Using adequate PD, epidermal cells and small vessels can retain more heat, resulting in selective thermal damages (selective photodermolysis principle).

Transitory purpura, crust formation, dyschromia (hyper- or hypopigmentation), which usually resolve within 4-6 months, have been reported with the administration of high fluence and short PD.[36]

In the present case, skin biopsy was not done because of the risk of non-aesthetic scarring; therefore, it was impossible to determine the depth of the vessels of the lesion. Due to reports in the literature of partial responses and considerable recurrence rates of PWS related with PDL and other low-penetration equipment, the Nd:YAG laser was used to potentiate the effects of IPL. A 1064-nm wave length was used to reach deeper and larger caliber vessels. Besides, the association of two light sources allowed the reduction of the fluence used by each one separately; this might have contributed for the good response to treatment and very low incidence of adverse reactions.

CONCLUSION

Although new treatments for PWS have developed over the last decades, complete regression is rare. The association of IPL and Nd:YAG laser seems to be a viable alternative in the treatment of this disorder,. and it seems very promising. with encouraging results and a minimal incidence of adverse reactions.S&CD

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