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CASE REPORT: Laser Treatment of PWS using a Combination of Q-s KTP and Long-Pulse Nd:YAG Lasers

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ABSTRACT

A port-wine stain (PWS) is a benign vascular malformation of the skin, which most often occurs on the face. It is usually red or violet, and can cause a significant impact on one's self-image. Among various treatments for PWS, laser therapy with lasers such as PDL, KTP Q-Switched and long-pulse Nd:YAG, has proven to be the safest and most efficient, since it can remove the lesion without harming the surrounding tissue.

In this case report, we observe the efficacy of combined treatment of facial PWS with KTP Q-s laser and long-pulse Nd:YAG laser. Clinical results have proven this method to be very effective in eliminating the lesion.

Key words: vascular lesions, long pulse Nd:YAG, KTP laser, port wine stain.

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I. INTRODUCTION

All benign vascular lesions of the skin have a tumor-like appearance; however, they are classified into two groups due to different micropathological properties. The first group is comprised of hemangiomas and pyogenic granulomas, which are proper proliferative benign tumors, whereas the lesions of the other group show only local dilatation of pre-existing vessels. They are therefore called vascular malformations or ectasias [1].

Port-wine stain (PWS) is a congenital capillary vascular malformation of the skin, occurring in 0.3% to 0.5% of newborns. It most often occurs in the trigeminal nerve distribution of the face, but can affect other areas of the body as well [2,3]. PWS is usually a large flat patch of purple or dark red skin with well-defined borders, which grows in size commensurate with the child, due to progressive dilatation of the abnormal vessels. The area becomes darker and thicker over time and can eventually take on a cobblestone-like appearance with overlying pyogenic granulomas. It is often reported that facial port-wine stains cause greater self-doubt in interpersonal interactions and can result in stigmatization from society for many affected individuals [4].

Many therapies, including cryotherapy, surgery, radiation therapy, and tattooing have been tested for port-wine stains, but laser therapy has been the most effective at eliminating them, since it is the only therapy that can selectively damage superficial blood vessels without significantly damaging the skin. Pulsed dye laser (PDL) is the therapy of choice for port wine stains, but the low penetration depth of PDL has some limitations in deeper port-wine stain types [5]. There are also several reports describing safe and effective use of 1,064 nm lasers for treatment of different vascular lesions as well as port-wine stains [6–9], but some caution is needed when using long-pulsed Nd:YAG laser to treat PWSs, because the 1,064 nm wavelength penetrates deeper into the tissue and may cause scarring of vascular and normal tissues. Frequency-doubled Nd:YAG (or KTP) lasers with 532 nm wavelength and a pulse duration of up to 50 ms have been reported to be a good alternative to PDL laser in PWS treatment [10,11], since they provide a better vessel penetration depth compared to the 585 nm wavelength of pulsed dye lasers. However, due to higher energy deposition in the basal epidermal layer, cooling is required to reduce epidermal damage [12].

Alternatively, a recent study of port-wine stain treatment with Nd:YAG/KTP laser, emitting simultaneously at 1,064 and 532 nm, was published [13].

Our aim was to evaluate the safety and efficiency of combinational treatment using Q-switched KTP in combination with 1,064 nm Nd:YAG laser for treatment of resistant port-wine stains.

II. CASE

a) Patient

A healthy, 41-year-old female, Fitzpatrick skin type 2, with facial PWS is being treated in our clinic with the aim of completely removing the facial lesion.

On her initial presentation, the port wine stain was red to dark purple and was distributed in the area of the first and second branch of the trigeminal nerve on the left side of the face (Fig.1). The patient claimed to have no known allergies or other diseases.

Fig. 1: Patient with red to dark purple port-wine stain on left side of the face before the laser therapy.

b) Methods and parameters of treatment

The treatment had to be adapted to the patient's needs due to her inability to take free days off of work and her desire to have longer session-free periods than recommended. Until now, we have completed 12 treatment sessions in 2 and a half years. Initially, the interval between sessions was one month, and later 2-4 months. The first nine treatments were done with Q-s 532 nm KTP laser (QX MAX, Fotona, Slovenia). In the following 3 treatments, long-pulse Nd:YAG (SP Dynamis, Fotona, Slovenia) was added after Q-s KTP.

No anesthesia was applied before the treatment, however, during each session, simultaneous cooling together with ice-packs was applied to minimize the pain and epidermal damage. The patent was advised to use 0.5 mg/1 mg betametazon/gentamicin cream (Diprogenta) together with cooling/ice packs for 2 to 3 days after the treatment to prevent inflammation and swelling.

We used the R28 handpiece for the Q-Switched KTP laser and the R33 handpiece for the long-pulse Nd:YAG laser. Only 1 pass with no overlapping was performed in each session. The parameters are listed in the table below.

Table 1: Parameters used for treatment of resistant port-wine stain.

Session	Laser Source	Spot size	Fluence	Frequency
1.	532 nm Q-sw KTP	3 *mm*	2.5 $\frac{J}{cm^2}$	2 Hz
2.	532 nm Q-sw KTP	3 *mm* / 4 *mm*	2.5 – 3.0 $\frac{J}{cm^2}$	5 Hz
3.	532 nm Q-sw KTP	4 *mm*	3.0 $\frac{J}{cm^2}$	5 Hz
4.	532 nm Q-sw KTP	4 *mm*	3.5 $\frac{J}{cm^2}$	5 Hz
5.	532 nm Q-sw KTP	4 *mm*	3.7 $\frac{J}{cm^2}$	3.5 Hz
6.	532 nm Q-sw KTP	4 *mm*	3.8 $\frac{J}{cm^2}$	3.5 Hz
7.	532 nm Q-sw KTP	4 *mm*	4.0 $\frac{J}{cm^2}$	3.5 Hz
8.	532 nm Q-sw KTP	4 *mm*	4.2 – 4.4 $\frac{J}{cm^2}$	3.5 Hz
9.	532 nm Q-sw KTP	4 *mm*	4.5 $\frac{J}{cm^2}$	3.5 Hz
10.	532 nm Q-sw KTP	4 *mm*	4.5 $\frac{J}{cm^2}$	2.0 Hz
	+ 1064 nm Q-sw Nd:YAG	4 *mm*	4.5 $\frac{J}{cm^2}$	2.0 Hz
11.	532 nm Q-sw KTP	4 *mm*	4.7 $\frac{J}{cm^2}$	2.0 Hz
	+ 1064 nm LP Nd:YAG	4 *mm*	220 $\frac{J}{cm^2}$	2.0 Hz
12.	532 nm Q-sw KTP	2 *mm*	4.0 $\frac{J}{cm^2}$	2.0 Hz
	+ 1064 nm LP Nd:YAG	4 *mm*	240 $\frac{J}{cm^2}$	2.0 Hz

The treatment was tolerated well by the patient. She reported a slight burning sensation for 30 minutes after the treatment and moderate oedema of the face for the next 2 to 3 days. Redness of the treated area developed immediately after the treatment and subsided gradually in the following 2-3 weeks, especially after 1 one week, when the treated epidermis peeled off and only minor redness resided (Fig.2).

Fig 2: The development of redness and moderate oedema appeared immediately after the treatment and gradually disappeared.

III. RESULTS

The treatment has revealed excellent results. We have observed the complete removal of the lesion in some areas and a significant reduction of the lesion's color in the others. As the PWS began to fade during treatment, a few small nodular lesions, resembling

hemangiomas or small pyogenic granulomas, became apparent (Fig 3). These weren't responding to KTP Q-Switched treatment, hence, a long-pulse Nd:YAG laser has been introduced following the 8th session to target these nodules. The nodules subsided gradually after each session (Fig. 4).

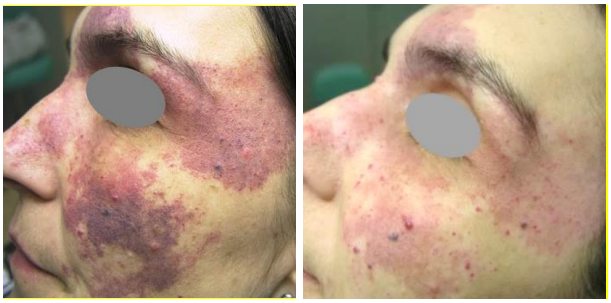

Fig 3: PWS before the treatment (left) and after 8 sessions of treatment with 532 nm Q-switched KTP (right).

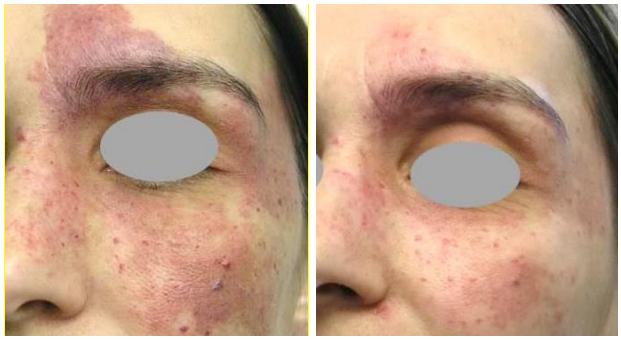

Fig 4: PWS after 1st session of treatment with 532 nm Q-switched KTP (top) and after complete treatment (12 sessions) using 532 nm Q-switched KTP combined with long-pulse 1,064 nm Nd:YAG when the treatment was completed (bottom).

IV. DISCUSSION

When considering the best laser treatment for the removal of vascular skin lesions, one has to bear in mind not only the laser properties, but also the depth and thickness of the lesion. There are several laser products for PWS removal on the market and, in our case report, we observed a successful outcome with a combination of Q-Switched KTP and long-pulse Nd:YAG laser.

Q-s KTP laser has a shorter 532 nm wavelength and has thus the maximum absorption in the blood chromophores of the superficial vessels. It is therefore optimal for treating port-wine stains, because they lie superficially in the upper reticular dermis [4]. The additional advantage of the laser is better penetration depth in comparison to PDL laser, which makes it more efficient in treating deeper PWS types.

Nodular vascular lesions, usually pyogenic granulomas, can develop during the evolution of the PWS [4]. Similarities were spotted on our patient. The nodular vascular lesions are thicker and Q-s KTP beams cannot reach through their entire depth due to a very high absorption in the upper vessel chromophores. Long-pulse Nd:YAG laser, on the other hand, has lower absorption and deeper penetration and is therefore the preferred treatment for this kind of lesion.

V. CONCLUSIONS

On the basis of the observed results, we can claim that the proposed combined therapy using Q-s KTP and long-pulse Nd:YAG lasers offers an efficient and safe treatment option for the complete removal of even the most complex port-wine stains.

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