

Relationship Between Dermoscopic Vascular Pattern and Laser Efficacy in Children with Port Wine Stains

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Abstract: *Objective:* To investigate the relationship between dermoscopic vascular pattern and laser efficacy in children with port wine stains. *Methods:* From January 2023 to December 2023, 43 children aged 3 to 18 years old with port wine stains in our hospital were selected. The Optimex dermoscopy (American Cynosure Company, Model: M393) was used to observe the vascular pattern and clinical efficacy. *Results:* There were 14 cases (31.11%) of linear blood vessels, 10 cases (22.22%) of dotted blood vessels, eight cases (17.78%) of reticular blood vessels, seven cases (15.56%) of short rod-shaped blood vessels, three cases (6.67%) of mixed-type blood vessels, and three cases (6.67%) of uniform red background pattern. According to the results of dermoscopy, the effective rates of six types of blood vessels, linear blood vessels, dotted blood vessels, reticular blood vessels, short rod-shaped blood vessels, mixed-type blood vessels, and uniform red background pattern were 71.43%, 100%, 62.50%, 100%, 66.67%, and 33.33%, respectively. The difference was statistically significant ($P < 0.05$). *Conclusion:* The treatment efficacy of pulsed dye laser on port wine stains varies with different vascular patterns, and the effects on dotted, short rod-shaped, and linear blood vessels are better.

Keywords: Port wine stain; Dermoscopy; Vascular pattern; Laser efficacy

Online publication: July 17, 2024

1. Introduction

Port wine stains (PWS) are a common capillary malformation that occurs in the head, neck, and trunk. Its main feature is bright red patches or plaques, mostly occurring in children^[1]. PWS appears at birth or shortly after birth and is characterized by red plaques with different shapes on the skin surface. The size and color of these plaques may change over time, causing psychological and physiological distress to children and their families^[2]. Laser therapy has become a common choice for its treatment because it can effectively reduce or even eliminate the color and size of the lesion^[3]. In recent years, with the development of laser technology, the treatment effect of PWS is getting better and better. There are various treatment methods for PWS, including laser, radiofrequency, freezing, and other treatment methods. Among them, the efficacy of laser and radiofrequency technology for PWS has been widely recognized, but its characteristics of vascular structural damage need to

be further explored ^[4]. As a means of directly observing the vascular structure in the skin, dermoscopy has been widely used in clinical practice. Its advantage is that it can judge the integrity of the vascular structure and its damage degree by directly observing the changes in vascular structure, and can quantitatively measure the diameter of blood vessels at different time points after treatment ^[5]. However, the therapeutic effect is affected by many factors, one of which is the vascular pattern observed under the dermoscopy. Various types of vascular patterns (such as linear, dotted, reticular, short rod-shaped, and mixed-type) may have different effects on the efficacy of laser therapy ^[6]. Therefore, understanding the relationship between these vascular patterns and laser efficacy is of great significance for the development of more accurate and effective treatment options. In the existing studies, some scholars have begun to explore the relationship between the dermoscopic vascular pattern and the therapeutic effect of port wine stains ^[7,8]. However, the results of these studies are inconsistent, and most studies have a small sample size and lack long-term follow-up data. Further research is necessary to gain insight into the association between vascular patterns and laser efficacy, and to provide clinicians with more reliable and practical treatment recommendations. Therefore, the purpose of this study is to explore the relationship between the dermoscopic vascular pattern of PWS in children and the efficacy of laser therapy. Through an in-depth study of the effects of different types of vascular patterns on laser therapy, we hope to provide clinicians with more accurate and personalized treatment recommendations.

2. Materials and methods

2.1. General information

From January 2023 to December 2023, 43 children aged 3 to 18 years with port wine stains were selected in our hospital, including 23 males and 20 females, aged 3 months to 18 years. All patients had different degrees of skin lesions, including 31 cases of red patches, 10 cases of erythematous plaques, and four cases of telangiectasia.

Inclusion criteria: (1) There was a clear clinical diagnosis and treatment needs; (2) Aged 3 months to 18 years old; (3) All the children were treated for the first time, and it was clear that there was no contraindication for laser treatment or surgical treatment; (4) Children and their parents provided informed consent and signed informed consent. Exclusion criteria: (1) Children with severe dysfunction such as affecting surgical operation, severe infection, and limb disability; (2) Mental retardation or other diseases affecting intellectual development; (3) Presence of other systemic diseases such as systemic lupus erythematosus, tuberous sclerosis, etc.

2.2. Methods

2.2.1. Treatment

The Optimex dermoscopy (American Cynosure Company, Model: M393) was used to observe the vascular pattern, including vascular morphology, density, distribution, etc., in order to evaluate the severity of the disease and develop a treatment plan. A pulsed dye laser was used three times, with an interval of 4 weeks. The dermoscopic vascular morphology of the erythema site was observed and measured by the clinician through the naked eye, while the erythema plaque was automatically calculated by the computer system and recorded by the clinician. The dermoscopic vascular morphological parameters of the lesion site were compared with the erythema plaque area automatically calculated by the computer system to evaluate the correlation between the two.

2.2.2. Nursing methods

Before laser treatment, the children and their parents were informed of the purpose, methods, and precautions of treatment, and informed consent was signed. The necessary physical examination was carried out to ensure that the children have no contraindications for laser treatment. In the process of laser treatment, the children were made comfortable and avoided excessive tension or pain. The medical staff monitored the vital signs of the

children throughout the course and dealt with the possible adverse reactions in time. After laser treatment, the treatment area was kept clean and dry to avoid infection. Children avoided scratching the treatment area to prevent unnecessary trauma. During the treatment process, regular follow-ups were conducted to timely understand the changes in the condition and adjust the treatment plan. As port wine stains can affect the appearance and mental health of children, medical staff and parents paid attention to the psychological status of children, provided care and support, explained the effect and possible risks of treatment to children and parents, and avoided excessive anxiety and high expectations.

2.3. Observation indicators

Observation indicators include vascular patterns and clinical efficacy.

2.4. Statistical methods

SPSS25.0 software was used to statistically process the data of this study. The count data were expressed as percentages and the measurement data were expressed as mean \pm standard deviation (SD). The count data were tested by χ^2 and the measurement data were tested by *t*-test. $P < 0.05$ indicated that the difference was statistically significant.

3. Results

3.1. Vascular pattern

Dermoscopic examination of skin lesions before the first treatment showed that 45 patients with PWS were divided into six types of blood vessels: 14 cases (31.11%) of linear blood vessels, 10 cases (22.22%) of dotted blood vessels, eight cases (17.78%) of reticular blood vessels, seven cases (15.56%) of short rod-shaped blood vessels, three cases (6.67%) of mixed-type blood vessels, and three cases (6.67%) of uniform red background pattern.

3.2. Clinical efficacy

According to the six types of blood vessels classified by the results of dermoscopy, the effective rates of linear blood vessels, dotted blood vessels, reticular blood vessels, short rod-shaped blood vessels, mixed-type blood vessels, and uniform red background pattern were 71.43%, 100%, 62.50%, 100%, 66.67%, and 33.33%, respectively. The difference was statistically significant ($P < 0.05$), as shown in **Table 1**.

Table 1. Clinical efficacy

Types	Healed	Effective	Ineffective	Effectiveness	χ^2	<i>P</i>
Linear vessels (<i>n</i> = 14)	5	5	4	10 (71.43)	16.243	< 0.05
Dotted vessels (<i>n</i> = 10)	6	4	0	10 (100.00)		
Reticular vessels (<i>n</i> = 8)	3	2	3	5 (62.50)		
Short rod-shaped vessels (<i>n</i> = 7)	4	3	0	7 (100.00)		
Mixed-type vessels (<i>n</i> = 3)	0	2	1	2 (66.67)		
Uniform red background pattern (<i>n</i> = 3)	0	1	2	1 (3.33)		

4. Discussion

PWS is a common vascular malformation that occurs in the head, neck, and trunk. The main clinical manifestations are red or white patches on the skin, mostly localized, and some patients may have telangiectasia. The treatment

of PWS is mainly based on laser and radiofrequency technology. Laser therapy is considered to be one of the most effective treatments, but it is still controversial. At present, it is believed that laser therapy can effectively improve the vasodilatation of PWS lesions, thereby improving their clinical symptoms and enhancing the quality of life of children^[9]. As an objective method to evaluate the changes in vascular morphology and diameter, dermoscopic vascular pattern has been widely used in dermatology^[10]. The vascular patterns of port wine stains are mainly divided into three types: reticular type, tubular type, and mixed type. The reticular vascular pattern involves blood vessels interwoven in a network, and the vascular lumen is thin. The tubular vascular pattern is dominated by thick blood vessels, which are tubularly distributed. The mixed type is a mixture of reticular and tubular types, and different types of vascular patterns show different reactions and effects during treatment^[11].

In this study, 45 patients with PWS were divided into six types of blood vessels: 14 cases (31.11%) of linear blood vessels, 10 cases (22.22%) of dotted blood vessels, eight cases (17.78%) of reticular blood vessels, seven cases (15.56%) of short rod-shaped blood vessels, three cases (6.67%) of mixed-type blood vessels, and three cases (6.67%) of uniform red background pattern. The effective rates of linear blood vessels, dotted blood vessels, reticular blood vessels, short rod-shaped blood vessels, mixed-type blood vessels, and uniform red background patterns were 71.43%, 100%, 62.50%, 71.43%, 66.67%, and 33.33%, respectively. The difference was statistically significant ($P < 0.05$), indicating that the treatment efficacy of pulsed dye laser on port wine stains varies with different vascular patterns, and the efficacy on dotted, short rod-shaped, and linear blood vessels was better. This is mainly because the dotted, reticular, and mixed-type blood vessels are more complex than the linear and short rod-shaped vessels. Complex vascular structure may mean stronger blood flow and higher vascular density, which may affect the absorption and therapeutic effect of laser. Therefore, for children with port wine stains with complex vascular patterns, it may be necessary to adjust the laser power, frequency, or pulse width to obtain better results. The uniform red background pattern may indicate a shallower lesion depth, while other patterns may involve deeper blood vessels. Deep blood vessels may resist the absorption and action of the laser, resulting in poor therapeutic effect. For deep vascular lesions, a longer wavelength laser can be considered to increase the penetration and effect on deep blood vessels. The skin condition, body reaction, and metabolism of each child are different, which may affect the effect of laser treatment. In future studies, these individual differences can be included in the evaluation of treatment effects, so as to provide a more accurate treatment plan for each child. Different treatment options may be required for different types of vascular patterns and color patterns. For example, for the dotted vascular pattern, increasing the frequency of treatment or using different laser parameters can be considered; for the mixed-type vascular pattern, it may be necessary to combine multiple treatment methods to achieve the best results. Although short-term treatment efficiency is an important indicator, long-term follow-up observations are equally important for assessing the persistence of treatment effects and possible side effects. Long-term follow-up is recommended for all children to better understand the long-term effects of different treatment modalities. Parents also play a vital role in the treatment of children^[12]. Their attitude, attention, and cooperation with the treatment directly affect the treatment effect. Therefore, the education and communication of parents are also an important part of the treatment process. In order to further improve the effect of laser treatment on port wine stains, the following points can be considered: (1) Strengthening the awareness of doctors and parents on port wine stains; (2) Selecting the best treatment time and laser treatment parameters; (3) Making personalized treatment plan according to different skin lesions; (4) Strengthening the long-term follow-up and disease monitoring of patients.

5. Conclusion

In summary, the treatment efficacy of pulsed dye laser on port wine stains varies with different vascular patterns, and the efficacy of the dotted, short rod-shaped, and linear vascular patterns is better. With the

continuous progress of medical technology, the treatment of port wine stains is also developing and improving. In the future, more innovative treatment methods are expected, such as new laser equipment and photodynamic therapy, which can improve the treatment effect, reduce the recurrence rate, and bring a better treatment experience to patients with port wine stains. At the same time, further in-depth study of the relationship between vascular patterns and treatment efficacy will help to better guide clinical treatment and improve the pertinence and effectiveness of treatment. In addition, strengthening patient education and paying attention to patients' mental health are also aspects that require emphasis in future treatment, which helps to improve patients' treatment confidence and quality of life.

Disclosure statement

The author declares no conflict of interest.

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