

Research Article

Efficacy of Pulse Dye Laser for Hypertrophic Scars and Keloids

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Abstract

Background: Keloids and hypertrophic scars are a common problem encountered by plastic surgeons. Traditional treatments like intralesional steroids, or excision have high recurrence rate and often suboptimal results. Pulse Dye Laser is a relatively newer modality for treatment of such scars, especially if administered within the first 12 months.

Objective: The Objective of this study is to determine the efficacy of pulse dye laser in treatment of hypertrophic scars and keloids.

Methodology: This descriptive case series was carried out at Pak Italian Modern Burn center, Nishtar Medical University and Hospital Multan. All patients who presented with keloids and hypertrophic scars over a period of one year from 01 April 2020 to 31st March 2021 were included in the study. All patients underwent 3 sessions of PDL therapy. Effectiveness of pulsed dye laser was assessed in terms of vascularity, pigmentation and pliability.

Results: After three sessions of PDL, 32(80%) patients were able to achieve 'normal' vascularity; 38(95%) patients achieved normal pigmentation; and 24(60%) patients were able to have pliable skin.

Conclusion: Pulse dye laser is very effective in treatment of keloids and hypertrophic scarring. Its noninvasive, and easily tolerable especially in children with negligible adverse effects.

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Introduction

Due to complex physiological cascade of wound healing, there is always scar formation following any injury to the deep dermis. These physiological events can be grouped under distinct phases of inflammation, proliferation, and remodeling.^{1,2,3,4} In normal wound healing the inflammatory and proliferative phases last about 2 weeks, and are characterized by the formation of granulation tissue. At this time, contraction of wound is initiated by myofibroblasts. Once wound closure is achieved, remodeling phase begins, in which there is gradual degradation of extracellular matrix. The balance between collagen synthesis and breakdown/lysis results in the formation of a normal scar.

Proliferative scar formation describes a series of events

that result in overhealing due to a disbalance in the above-mentioned equilibrium. The two types of proliferative scars are hypertrophic scars and keloids. Besides the obvious aesthetic concerns, such scars are often associated with functional problems like pain, pruritis and limitation of movement.

Traditional treatments like surgical excision, corticosteroid injections and continuous laser destruction have mixed results in treating keloids and hypertrophic scars with reports of high recurrence rates. Also, in children, general anesthesia is often required for most of these procedures.

The difficulty to assess the efficacy of existing treatment modalities is due to the limited numbers of controlled, comparative studies of the effectiveness of available treatment options in improving the appearance and/or

symptoms of hypertrophic scars especially for new scars of less than 12 months' duration.

In the past several years, the pulse dyed laser has been successfully used in treatment of such scars, with promising results.⁵ Some of its advantages include ease of use, patient comfort, and avoidance of anesthesia in the pediatric population.⁶

A study by Cannarozzo G, et al. has showed the efficacy of pulse dye laser to be 49.1% in treatment of keloids scars.⁷

In another study, Chan HH, et al. have reported the efficacy of pulse dye laser to be 66% in treatment of hypertrophic scars.⁸

Most previous studies investigated the use of lasers in patients with lighter skin types^(7,8) whereas, the use of lasers for treatment of hypertrophic and keloids scars in dark skinned patients like our local population is not well established. The rationale of this study is to determine the efficacy of pulse dye laser in treatment of keloids and hypertrophic scars in darker skin types of Pakistani population,

Methodology

This descriptive case series was carried out at Pak Italian Modern Burn centre, Nishtar University and hospital. All patient presenting with keloids and hypertrophic scars during a one-year period from 1st April 2020 till 31st March 2021 were included in the study. Exclusion criteria were scars present for more than 12 months duration, and any condition preventing the patient from sitting still during the session.

Demographic data (such as age and gender), type of scar (hypertrophic vs keloid), and duration of scar were noted pre-operatively and recorded on a proforma.

Scar characteristics of vascularity, pigmentation, and pliability were assessed by a single person pre-treatment and recorded, as follows:

Vascularity:

normal-pink-red-purple

Pigmentation:

hypopigmented-normal-hyperpigmented

Pliability:

normal-supple-yeilding-firm-bending

Standard laser safety measures were undertaken and an occlusive dressing with Lidocaine/prilocaine cream was applied for about an hour before session. All patients underwent treatment with Flash lamp pulsed dye laser

(585nm, Candela, SPTL-1 b Laser System, USA), at a fluence of 5-7 J/cm². Pulse duration of 450µsec and spot sizes of 5 and 7mm, were used. Treatment was carried out with pulses overlapping of up to 10%. After treatment, antibiotic and sun protection cream were given and patients were advised to avoid sun exposure. Treatment was repeated at 4 week intervals for three months. Scar was reassessed at 1-month intervals for the same three characteristics of vascularity, pigmentation and pliability. Pre and post-treatment scar characteristics were compared individually within the patient population

Results

After 3 months of treatment, 32(80%) patients showed excellent results in terms of 'normal' vascularity, as opposed to none of the patients being in the 'normal' category pre-operatively. 4(10%) patients had pink coloration, 2(5%) patients had red coloration, while in 2(5%) patients, the scar remained purple. Details are shown in bar graph in Figure 1. Figure 2 shows pre and post-operative pictures of a representative patient.

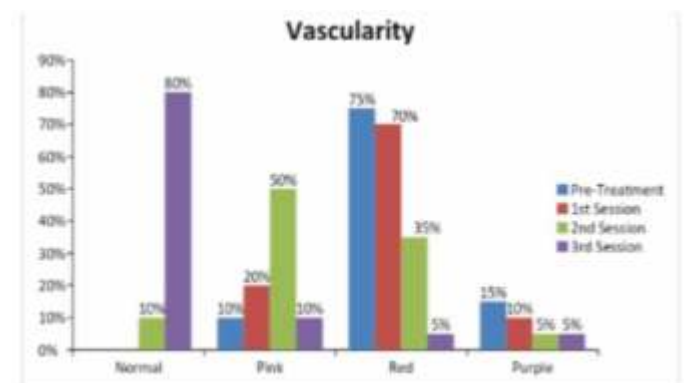


Figure 1: Cases in term of vascularity pretreatment and during 1,2 & 3month intervals



Figure 2: (a) pre-operative and (b) post-operative pictures showing improvement in vascularity

With respect to pigmentation, 38(95%) patients had normal color post-treatment, as opposed to 34(85%). The details are depicted in Table 1, and figure 3 shows

pre-and post-op pictures of a representative case.

Table 1: Cases in term of Pigmentation Results at 1, 2 & 3 month Intervals

	Pigmentation		
	Hypo-pigmentation	Normal	Hyper-pigmentation
Pre Treatment	0	34	6
1st Session	0	36	4
2nd Session	0	38	2
3rd Session	0	38	2

Scar firmness and lack of pliability was most challenging to treat. In our study, 24(60%) patients had 'supple' skin after treatment, versus none before treatment.⁶ (15%) patients still has firm and unyielding skin even after 3 sessions of PDL treatment. Table 2 describes the details of skin pliability.

Discussion

Keloid and hypertrophic scars are difficult conditions to treat, especially in the case of children. Different treatment modalities are available, but they are often painful and time consuming. Recurrence rates are also quite high for these lesions Sometimes due to these reasons, compliance is very poor.

For past several years, treatment of hypertrophic scars and keloids with lasers, specifically PDL laser, has shown promising results.

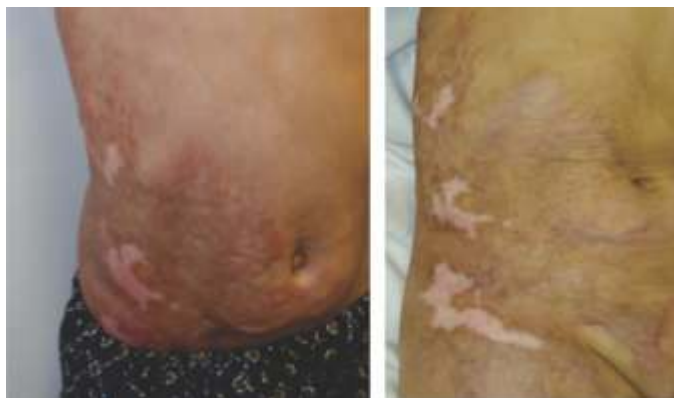


Figure 3: (a) pre-op and (b) post-operative appearance of scar pigmentation

Table 2: Skin pliability

	Pliability				
	Normal	Supple	Yielding	Firm	Bending
Pre Treatment	0	0	4	36	0
1st Session	0	2	10	28	0
2nd Session	0	16	12	8	0
3rd Session	0	24	10	6	0

It is thought that the improvement in hypertrophic scars and keloids with the use of pulse dye laser is due to hypoxemia generated by destruction of capillaries by PDL, which in turn increases local collagen production.⁹ Some studies in past have reported that with PDL there is decrease in expression of transforming growth factor beta-1, which stimulates the production of matrix metalloproteinases including collagenase.¹⁰ According to Alster and colleagues, up to six sessions may be needed for noticeable improvement in scar color, height, texture and pliability. This study reported few side effects like erythema and purpura, which settled in a week or two.² In 2017 Annabathula et al.¹³ found that 8(73%) out of 11 lesions showed improvement in size and erythema/color of keloids with PDL therapy.

Keeping in mind the favorable safety profile of the 595 wavelength PDL, and the satisfactory outcomes reported in the above-mentioned studies, we opted to choose this laser for our study. Also, for Asian skin type, a laser having longer wavelength and low absorption are better^(11,12). Larger sizespot (10 mm) can enhance the deeper penetration and therefore could be better than a smaller size spot (5 mm or 7 mm).

With our study we were able to get good results with 90% patients having excellent and good response in vascularity. In our study, we noticed that firmness and a non-yielding nature are hallmarks of hypertrophic scars and keloids and are somewhat difficult to treat, with only 24(60%) patients being able to achieve supple skin.

One limitation of the study is that we looked at collective outcomes and did not compare and score the pre and postoperative scars of each patient individually. Also we did not compare subgroups of keloids versus hypertrophic scars.

Conclusion

Pulse dye laser is a good alternative to treat hypertrophic scars and keloids. It is painless, therefore it is a very useful modality in children. Side effects are negligible and self-limiting.

Conflict of Interest None

Funding Source None

References

- desJardins-Park HE, Mascharak S, Chinta MS, Wan DC, Longaker MT. The spectrum of scarring in craniofacial wound repair. *Frontiers in physiology*. 2019;10:322.

2. Gauglitz GGJC, cosmetic, dermatology i. Management of keloids and hypertrophic scars: current and emerging options. 2013;6:103.
3. Arango Duque G, Descoteaux AJFii. Macrophage cytokines: involvement in immunity and infectious diseases. 2014;5:491.
4. Brown BN, Badylak SFJTR. Extracellular matrix as an inductive scaffold for functional tissue reconstruction. 2014;163(4):268-85.
5. Yun SH, Kwok SJ. Light in diagnosis, therapy and surgery. Nature biomedical engineering. 2017; 1(1): 1-16.
6. Mamalis A, Lev-Tov H, Nguyen DH, Jagdeo JJotEAoD, Venereology. Laser and light-based treatment of Keloids-a review. 2014;28(6):689-99.
7. Cannarozzo G, Sannino M, Tamburi F, Morini C, Nisticò SP. Flash-lamp pulsed-dye laser treatment of keloids: results of an observational study. Photomedicine and laser surgery. 2015;33(5):274-7.
8. Chan HH, Wong DS, Ho W, Lam L, Wei WJDs. The use of pulsed dye laser for the prevention and treatment of hypertrophic scars in Chinese persons. 2004; 30(7): 987-94.
9. Pongcharoen P, Pongcharoen B, Disphanurat W. The effectiveness of a 595 nm pulsed-dye-laser in the treatment of surgical scars following a knee arthroplasty. Journal of Cosmetic and Laser Therapy. 2019; 21(6): 352-6.
10. Kuo YR, Jeng SF, Wang FS, Chen TH, Huang HC, Chang PR, et al. Flashlamp pulsed dye laser (PDL) suppression of keloid proliferation through down-regulation of TGF- β 1 expression and extracellular matrix expression. 2004;34(2):104-8.
11. Kono T, Erçöçen AR, Nakazawa H, Honda T, Hayashi N, Nozaki MJAops. The flashlamp-pumped pulsed dye laser (585 nm) treatment of hypertrophic scars in Asians. 2003;51(4):366-71.
12. Kono T, Erçöçen AR, Nakazawa H, Nozaki MJAops. Treatment of hypertrophic scars using a long-pulsed dye laser with cryogen-spray cooling. 2005; 54(5): 487-93.
13. Annabathula A, Sekar CS, Srinivas CR. Fractional Carbon Dioxide, Long Pulse Nd:YAG and Pulsed Dye Laser in the Management of Keloids. J Cutan Aesthet Surg. 2017 Apr-Jun;10(2):76-80