

Philadelphia College of Osteopathic Medicine DigitalCommons@PCOM

PCOM Physician Assistant Studies Student
Scholarship

Student Dissertations, Theses and Papers

2014

Is Pulse-Dye Laser Therapy an Effective Treatment for Burn Scars?

Slade G. Rankin

Philadelphia College of Osteopathic Medicine, sladera@pcom.edu

Follow this and additional works at: http://digitalcommons.pcom.edu/pa_systematic_reviews

 Part of the [Tissues Commons](#)

Recommended Citation

Rankin, Slade G., "Is Pulse-Dye Laser Therapy an Effective Treatment for Burn Scars?" (2014). *PCOM Physician Assistant Studies Student Scholarship*. 188.

http://digitalcommons.pcom.edu/pa_systematic_reviews/188

This Selective Evidence-Based Medicine Review is brought to you for free and open access by the Student Dissertations, Theses and Papers at DigitalCommons@PCOM. It has been accepted for inclusion in PCOM Physician Assistant Studies Student Scholarship by an authorized administrator of DigitalCommons@PCOM. For more information, please contact library@pcom.edu.

Is Pulse-dye Laser Therapy An Effective Treatment For Burn Scars?

Slade G. Rankin, PA-S

A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For
The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies
Philadelphia College of Osteopathic Medicine
Philadelphia, Pennsylvania

December 20, 2013

ABSTRACT

OBJECTIVE

The objective of this selective EBM review is to determine whether or not pulse-dye laser therapy is an effective treatment for burn scars.

STUDY DESIGN

Systematic review of two randomized controlled trials and one case series study published in 1998, 2003, and 2012.

DATA SOURCES

Two randomized controlled trials and one case series study published after 1997 were obtained using Medline and PubMed

OUTCOMES MEASURED

Symptoms of pruritus, pain, and burning sensation measured for improvement by patient survey of pain scales and parent's reports of complaints in pediatric patients with symptoms by way of pain scales and medication requests. Cosmetic appearance was measured by physician and patient evaluation, photograph of pre and post treatment burn scar evaluation by blinded non-medical evaluators, 3D topographic imaging, and the Vancouver Scar Scale.

RESULTS

Bailey *et al.* (2012) and Alster *et al.* (1998) demonstrated improvement in a majority of the subjects' burn scar cosmetic characteristics, while Alster also showed significant improvement in burn scar pruritus. Allison *et al.* (2003) showed an improvement in pruritus symptoms but not significant in cosmetic appearance as compared to the control.

CONCLUSION

Evidence to support the efficacy of pulse-dye laser therapy as a treatment for the symptoms and cosmetic appearance of burn scars is inconclusive at this point in time due to the lack of a large subject population, standard of measurement, and a wide spectrum of subject age making it difficult to properly collect significant amounts of data to strongly support the efficacy of pulse-dye therapy in treating burn scars.

KEY WORDS

Pulse-dye laser therapy, burn scars

INTRODUCTION

Post-burn scars are a major source of morbidity and complications in a burn survivor's life, causing both symptomatic and cosmetic issues that are difficult to manage and typically persist throughout the burn survivor's life.¹ As of 2012, there are an estimated 450,000 burn injuries that require medical treatment annually, with a population ranging from infants to elderly.² The average cost of medical treatment for a burn patient varies from patient to patient, however an increase in cost can be related to a larger Total Body Surface Area percentage (TBSA) in burn patients, an average cost was found to be approximately \$73, 532 in the management of burn patients without considering the long-term management of chronic complications.³ In past years, it has been estimated that there is an average 450,000 burn incidences requiring medical treatment to some degree annually, about 40,000 of that estimate required hospitalization or specialized management in a burn center.²

Burn scars are caused by a variety of methods that cause burn injury to the skin, including but not limited to direct heat, chemicals, and electricity. The long term symptoms of pruritus and pain may be linked to interactions of immunomodulation agents and nerve ending damage.¹ The cosmetic disfigurement can be related to the habit of burn scars to develop skin/scar hypertrophy in the area of injury which can cause deformity, and contracture of the skin.¹

Current methods of treating burn scars symptomatically and cosmetically include applications such as glucocorticoid injections, silicone gel applications, massage therapy, retinoic acid and pressure garments.^{3,1} Currently, there is no superior method to treat scars that are caused by burns; all of the above have been shown to temporally relieve the

symptoms of burn scars but no one method shows to best reduce hypertrophy of burn scars.

Previous research has shown that the use of pulse-dye laser therapy has helped in decreasing the symptomology and decrease cosmetic disfigurement caused by various types of keloids and hypertrophic scar tissue.^{1,4} Pulse-dye laser therapy may hold potential for an alternative treatment of symptoms and disfigurement caused by burn scars. This paper reviews three studies: two randomized controlled trials (RCT), and one case series comparing the efficacy of pulse-dye laser therapy as a treatment of the symptoms and cosmetic disfigurement caused by burn scars to not receiving pulse-dye laser therapy.

OBJECTIVE

The objective of this systematic EBM review is to determine whether or not pulse-dye laser therapy is an effective treatment for burn scars.

METHODS

The criteria used in the selection of relevant articles was based upon similarity of their population, intervention, comparison technique, and measured outcomes. The population was limited to men and women with symptomatic burn scars. The intervention of interest that was used on the participants was pulse-dye laser therapy. The comparison group was not subjected to treatments of pulse-dye laser therapy. All of the studies measured the improvement of the burn scar symptoms (pruritus, pain, burning sensation) and cosmetic appearance (erythema, height, plasticity, elasticity, and texture) post treatment. The types of studies included two RCTs, and one case series.

The search for relevant articles started December 20th, 2012 and ended on February 7th, 2013. Articles found using Medline and PubMed were selected based on their relevance to the clinical question and for their emphasis on patient-oriented evidence based medicine (POEM). Keywords utilized in the location of articles included, “pulse-dye laser therapy” and “burn scars.” The inclusion criteria for articles was limited to randomized controlled trials or case series methods that were written in English and published in peer-reviewed journals. The exclusion criteria for articles included participants who were pregnant, and children who were subject to abuse. Once both the inclusion and exclusion criteria was applied, three articles were selected. The three articles include: Allison KP, Kiernan MN, Waters RA, Clement RM (2003), a randomized controlled trial; Bailey JK, Burkes SA, Visscher MO, et al (2012), a randomized, blind, controlled trial; Alster TS, Nanni CA (1998), a case series study.

All three studies included POEM in the form of continuous data which could not be converted to dichotomous data. Statistics reported or used in these studies include paired t-test, p-values, change in mean from baseline, and F-scores.

Table 1: Demographics & Characteristics of Included Studies

Study	Type	# Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Bailey <i>et al.</i> (2012) ³	Blind RCT	13	≥9 years	-scheduled to undergo burn scar revision at Shriners Hospitals for Children in Cincinnati, Ohio -≥9 years -Scars on extremities -could return for evaluation and treatment	-Pregnant women	7	Early pulsed-dye laser treatment plus compression therapy
Allison <i>et al.</i> (2003) ⁴	RCT	38	Children to adults	-“new” burn scars (<3months) -“old” burn scars (>3months)	-children subject to abuse -children difficult to manage -florid psychiatric problems or chronic ETOH addiction	4	Pulsed-dye laser treatment of 585nm with a 5mm diameter spot at 5-6J/cm ² in monthly intervals
Alster <i>et al.</i> (1998) ⁵	Case Series	16	16-77 years	- burns suffered 1 month to 16 years prior to study	-burns suffered <1month prior to study	0	Pulse dye laser treatment

OUTCOMES MEASURED

All three studies measured either the improvement of burn scar symptoms (pruritus, pain, and burning sensation), improvement of the cosmetic appearance (erythema, height, plasticity, and texture), or both. Bailey *et al.* (2012) measured the cosmetic improvement of burn scar graft seams by using the Vancouver Scar Scale (VSS) which is a criteria used to evaluate scar pliability, vascularity, height, and pigmentation, digital photography, and 3D topographical imaging. Allison *et al.* (2003) measured the improvement of burn scar pruritus, erythema and surface texture by using VSS, histology, surface texture analyses, patient pruritus scale scores, average roughness standard, parent observation of child with burn scars. Alster *et al.* (1998) measured the improvement of burn scar pruritus, erythema, texture, and pliability by use of sequential photography, and scar assessment scale scores from both a clinician and the patient. The scale scores ranged from 0-3 (0=no improvement, 1=minimal improvement, 2=moderate improvement, 3=vast improvement).

RESULTS

Bailey *et al.* (2012) studied patients 9 years old or older with burn scars on extremities (excluding hands) who were scheduled to undergo burn scar revision at Shriners Hospital for Children in Cincinnati, Ohio. Only the data from subjects who completed at least two treatments was included in the analysis. The authors reported that a significant reduction in burn scar/graft seam erythema and scar height with the use of pulsed-dye laser treatment (PDLT) in combination with compression therapy (CT) compared to CT alone through at least two PDLT treatments ($p < .05$), with an increase in

elasticity and further decrease in scar height after three PDLT treatments+ CT compared to CT alone, ($p<.05$).

Table 2. Bailey *et al.* (2012) VSS Height Comparison of PDLT+CT vs. CT alone

Scar Height	PDLT+CT	CT alone	p-value
Baseline (prior to treatment)	0.4±0.1mm	0.1±0.1mm	p<.05
After three treatments	0.07±0.04mm	0.20±0.04mm	p<.05

Allison *et al.* (2003) studied adults and children with “old” and “new” burn scars which were divided into two halves (“experimental” half of scar received PDLT, the other “control” half did not). All of the subjects whose data was collected were analyzed in the group that they were assigned into originally. For those lost to follow-up, little data was available. At the end of the study at 12 months, a significant reduction in burn scar pruritus was achieved with use of PDLT on the “experimental half of the burn scar compared to the “controlled” half receiving no PDLT ($P<0.001$), but with no improvement of erythema or surface texture that was comparable between the experiment and control halves.

Table 3. Allison *et al.* (2012) Paired t-test P-score Measurements for Experiment vs Control Areas

Time	VSS Scores	Photographic Assessment	Surface Profile Measurement
0 months	-	-	P=0.552
6 months	P=0.876	P=0.006	P=0.107
12 months	P=0.680	P=0.329	P=0.227

Alster *et al.* (1998) studied patients who suffered burns between 1 month and 16 years prior to the study. All of the subjects whose data was collected were analyzed in the case series study population. Both clinician and subject assessment scale scores substantiated each other. Average scale scores showed improvement from baseline in all regions (face, trunk, and extremities) to a rate between moderate to vastly improved (2-3 on scale). A significant reduction in burn scar pruritus was achieved in subjects who were experiencing it prior to treatment with PDLT. Of the 8 subjects reporting pruritus prior of their burn scars prior to the intervention, 100% of them reported improvement after 1-2 sessions of PDLT, ($p \leq 0.05$). Also a significant improvement in erythema, pliability, and texture of the scars was achieved with the use of PDLT in patients who have not achieved improvements with prior alternative treatment options in an average of 2.75 treatments. Scar pliability scores showed improvement from baseline after treatment, most scars prior to treatment were improved to supple: pretreatment scores (2.5-3.5) post treatment (1-1.5).

Allison *et al.* (2003) reported that one patient withdrew from the study because of scar breakdown, but it is unclear as to the cause of the incident. Otherwise, none of the studies used report any other outstanding adverse events in their research.

DISCUSSION

Some variability may have existed between the different methods of these studies that may have affected the outcomes. The specifications of the wavelength of laser varied, Allison *et al.* (2003) and Alster *et al.* (1998) reported using PDLT with wavelength of 585 nm while Bailey *et al.* (2012) used 595 nm, while Alster *et al.* (1998) reported improved cosmetic appearance, Allison *et al.* (2003) reported no significant

improvement in comparison of treatment to control at the end of the study. Bailey et al. (2012) reported significant improvement in cosmetic appearance with PDLT compared to the control.

While PDLT may seem like a viable option to treating symptoms and improving appearance of burn scars, it is questionable as to the availability of this option to a vast majority of the burn survivor population due to insurance coverage. Insurance may not be willing to pay for such a radical, expensive treatment while other cheaper options exist such as corticosteroid injection.

The studies used in this analysis have many limitations. One of the most significant ones is their small subject population size as well as the number of patients lost to follow-up. In Allison *et al.* (2003) study, the small group sizes may have accounted for the lack of statistical difference between the groups assessments. In the >3month “old” scar group, the subjects were commonly using pressure garments therapy or silicone gel and often had thicker scar tissue, both the control and treatment areas of scar were exposed to this, the pressure and silicone were not withheld from “new” scar patients.

CONCLUSION

At this time, the evidence is inconclusive to suggest that pulse-dye laser therapy is effective in treating symptoms and the cosmetic appearance of burn scars. One major flaw in these studies was the use of children, both Bailey *et al.* (2012) and Allison *et al.* (2003) used children in their subject populations, this could have greatly limited the amount of follow-up and subject input for symptoms in the study. A great improvement

for future studies would be to use adults exclusively, perhaps a war veteran population that are burn survivors. A population such as that would be of great benefit since there are many burn survivors who acquired their injuries in combat. This would ensure better subjective description of symptoms and would better guarantee follow-up of the study.

To better assess the use of PDLT in the use of burns in future studies, it would be best to use a very large, adult, compliant subject population. Data would be gathered using a standardized method of burn scar grading and try to incorporate the use of the double-blind strategy.

References

1. Allison KP, Kiernan MN, Waters RA, Clement RM. Pulsed dye laser treatment of burn scars. alleviation or irritation? *Burns*. 2003;29(3):207-213.
2. Burn incidence and treatment in the united states: 2012 fact sheet. American Burn Association Website. http://www.ameriburn.org/resources_factsheet.php. Accessed September 27th, 2013.
3. Ahn CS, Maitz PKM. The true cost of burns. *Burns*. 2012;38(7):967-974.
4. Bailey JK, Burkes SA, Visscher MO, et al. Multimodal quantitative analysis of early pulsed-dye laser treatment of scars at a pediatric burn hospital. *Dermatol Surg*. 2012;38(9):1490-1496. doi: 10.1111/j.1524-4725.2012.02451.x; 10.1111/j.1524-4725.2012.02451.x.
5. Alster TS, Nanni CA. Pulsed dye laser treatment of hypertrophic burn scars. *Plast Reconstr Surg*. 1998;102(6):2190-2195.