

Evaluation of Treatment Methodologies of Hypertrophic Scars: Pulse-Dyed Laser, Erbium Laser and Corticosteroid Injection

Evaluation of Treatment Methodologies of Hypertrophic Scars

Usman Jahangir, Seemab Khan and Tooba Malik

ABSTRACT

Objective: To compare three treatment strategies for hypertrophic scars: corticosteroid injection, pulse-dyed laser, and Erbium laser.

Study Design: A cross-sectional comparative study

Place and Duration of Study: This study was conducted at the dermatology department of Bakhtawar Amin Trust Teaching Hospital Multan from Jan 2020 to Jan 2021.

Materials and Methods: After passing through the selection criteria, the patients were divided into three groups: corticosteroid, pulse-dyed laser, and erbium such that 20 patients were placed in each group. Patients in all three groups were photographed before and after four weeks of their respective treatments such that the specification of photographs was kept constant. Vancouver Burn Scar scale was used for the evaluation of the treatment outcomes. Moreover, vascularity and height scores were also assessed.

Results: A total of 60 patients were included in the study, 20 in each group. The mean VBS score of patients in the PDL group decreased significantly from 8.7 ± 1.5 to 3.9 ± 1.7 , $p = 0.001$. Similarly, the VBS score of patients in the Erbium group decreased significantly from 9.3 ± 1.3 to 5.2 ± 1.4 , $p=0.032$. However, no significant difference was found in the VBS score of patients in the corticosteroid group ($p>0.05$). The vascularity score was significantly improved in patients from PDL and erbium groups ($p=0.01$ and $p=0.02$, respectively). Similarly, height score was significantly improved in PDL (2.24 vs 1.45 , $p=0.1$) and erbium group (2.26 vs 1.39 , $p=0.02$) after the treatment.

Conclusion: Both pulse-dyed and erbium laser is significantly more effective than corticosteroid treatment in improving the Vancouver Burn Scar scale, vascularity, and height scores of hypertrophic scars.

Key Words: pulse-dyed laser, erbium laser, corticosteroids, hypertrophic scars, laser therapy

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INTRODUCTION

Any disturbance in the normal healing process usually ends up in chronic wounds and the formation of keloids and hypertrophic scars⁽¹⁾. Extensive scarring causes psychological stress, discomfort, and cosmetic deformities. Thus, scar management and prevention continue to be major issues in the field of plastic surgery.

Hypertrophic scars not only cause physical deformities but also functional disability. In this regard, various treatment strategies have been tested on patients.

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In this regard, corticosteroid injections are mainly considered in the management of keloids and hypertrophic scars, either alone or in combination with pressure or surgical therapy for larger lesions. Steroid treatment can begin after 1 month of surgical intervention and can be repeated every month depending upon serial assessments⁽²⁾. Similarly, laser therapy utilizes the principle of the importance of vascular proliferation in the initial stages of scar formation⁽³⁾. Since the enhanced production of extracellular material and collagen requires more nutrient supply to tissues, new vessel formation is incumbent. This is particularly an important mechanism underlying hypertrophic scars that have higher blood flows⁽⁴⁾. Thus, the vascular lasers alter the mechanisms of hypertrophic scars by reducing the number of blood vessels.

A prior study evaluated pulse dye laser and found that effective in the treatment of hypertrophic scars but treatment was only carried out on light-skinned patients⁽⁵⁾. Generally, the efficacy of lasers is dependent on race, the extent of skin pigmentation, and the type of laser used. The wavelength of pulse-dyed laser (PDL) is selectively taken by oxyhemoglobin⁽⁶⁾. It halts the

growth of new blood vessels within the targeted lesions, thus consequently reducing erythema, height, and size without compromising surrounding tissues⁽⁷⁾. Kuo et al. demonstrated keloid regression and enhanced apoptosis of keloid fibroblast following pulsed-dye laser treatment⁽⁸⁾.

Although extensive research has been conducted on the treatment of hypertrophic scars, no universally accepted management protocol has yet not been introduced. Earlier studies have reported the success of laser therapy in light-skinned patients while some have regarded them ineffective when compared with traditional treatment⁽⁹⁾. However, the population in Pakistan has a mixed-skin type. Therefore, the present study aims to compare three treatment strategies for hypertrophic scars: corticosteroid injection, PDL, and Erbium laser.

MATERIALS AND METHODS

A randomized cross-sectional study was conducted from 13th Jan 2020 to 13th Jan 2021 at Dermatology department of Bakhtawar Amin Trust Teaching Hospital Multan for 1 year. Patients with the following characteristics were randomly included in the study: Fitzpatrick class III, presence of linear erythematous hypertrophic scar of greater than 4 cm on the neck and head region that is < 1 year old, and scars caused due to surgical excision or trauma. Whereas the patients who had undergone steroid, laser, or treatment with silicone sheets were excluded from the study to avoid the confounding effect of the treatment on our study. The participants were informed of the study's objectives and their consent was sought. Similarly, ethical consent was taken from the ethical committee of the hospital. The patients were divided into three groups: corticosteroid, PDL, and erbium such that 20 patients were placed in each group. The treatment plan was designed for a maximum period of 1 year and was subjected at a 4-weeks interval but was immediately stopped on the resolution of the scar.

The hypertrophic scars of patients in the PDL group were subjected to a 585nm flashlamp-pumped pulsed-dye laser for a duration of 1.5µsec and with a maximum fluence of 9 J/cm². The fluence was reduced in case patients complained of blisters after the 1st treatment session. The patients in the Erbium group received 2940nm laser light for about 0-1 msec. Whereas the patients in the corticosteroid group were injected with 5-10 mg/ml of triamcinolone acetonide, monthly. A personal error was minimized by allowing two trained physicians to carry out independent measurements of the results in each group. Both physical inspection and photography were done to evaluate the changes after the treatment. Patients in all three groups were photographed before and after four weeks of their respective treatments such that the specification of photographs was kept constant.

Vancouver Burn Scar scale was used for the evaluation of the treatment outcomes. In this regard, 4 factors were considered: height, pliability, vascularity, and pigmentation. The severity of scar was scored from 0 to 13 where 0 being minimum while 13 was the most severe form⁽¹⁰⁾. The scar was bleached with a transparent tool to assess vascularity and pigmentation. Similarly, scar height was defined as the maximum elevation of the scar from skin level and a caliper was used for such evaluation.

Statistical Evaluation: SPSS (version 21) was used for statistical evaluation. The outcomes of treatment were represented as mean along with standard deviation. The student's t-test was used for assessing the significance of treatment by considering the mean values before and after the treatment. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 60 patients were included in the study, 20 in each group. Out of the 41 were male while 19 were female. The mean age of the patients was 29.4 ± 6.5 years. Whereas, the mean scar duration was 7.5 ± 3.2 months. There was no significant difference found between the three groups in terms of age and scar duration. All treatment plans were well-tolerated and no major side-effect such as infection, ulceration, and pigmentary change was observed. The mean VBS score of patients in the PDL group decreased significantly from 8.7 ± 1.5 to 3.9 ± 1.7, p = 0.001. Similarly, the VBS score of patients in the Erbium group decreased significantly from 9.3 ± 1.3 to 5.2 ± 1.4, p=0.032. However, no significant difference was found in the VBS score of patients in the corticosteroid group (p>0.05). Similarly, before the treatment, no significant difference was found in the VBS score of the three groups but following the treatment significant difference in VBS scores of the PDL and Erbium group with that of the Corticosteroid group was found (0.021 and 0.042, respectively).

Table I shows the vascularity score of the three study groups before and after the treatment. The vascularity score was significantly improved in patients from PDL and erbium groups (p=0.01 and p=0.02, respectively) Table I.

Similarly, the height score was significantly improved in PDL (2.24 vs 1.45, p=0.1) and the erbium group (2.26 vs 1.39, p= 0.02) after the treatment (Table II).

Table No.1: Vascularity score of three study groups before and after the treatment (N=60)

Vascularity score	Before treatment	After treatment	p-value
PDL group	2.5	1.2	0.01
Erbium group	2.4	1.1	0.02
Corticosteroid group	2.5	2.0	0.06

Table No.2: Height of three study groups before and after the treatment (N=60)

Height score	Before treatment	After treatment	p-value
PDL group	2.24	1.45	0.1
Erbium group	2.26	1.39	0.02
Corticosteroid group	2.21	2.01	0.07

DISCUSSION

Hypertrophic scar considerably affects the appearance of the individuals and is the cause of social stress. PDL has been in use for the last several years as an intervention for hypertrophic scars with an underlying principle that vascular proliferation significantly participates in the early steps of scar formation. In 1990, PDL was considered as a treatment of choice only after the other intervention failed to deliver the results. However, since the advent of the 21st century, it is recognized as a first-line treatment plan for treating hypertrophic scars. Many studies have reported the efficacy of PDL but the effectiveness of the treatment found in one race doesn't guarantee the same results in another race. Thus, the role of PDL in the treatment of hypertrophic scars and keloid remains equivocal ⁽¹¹⁾. Some studies have also contrasted results as they found the limited role of PDL in severe cases as those with intense pruritis and found it ineffective in improving scar texture, height, and redness ⁽¹²⁾. Therefore, our study has evaluated the efficacy of PDL and erbium laser and compared the two modalities with the conventional method of corticosteroid injections in patients with hypertrophic scars.

The study reported a significant role of PDL in improving VAS score, vascularity score, height score of hypertrophic scars. A similar clinical trial was conducted by Chan et al., who evaluated 56 patients with hypertrophic scars and found out that a treatment plan lasting for 3-6 weeks is effective in reducing scar thickness and yields patients' satisfaction. However, the maturity level of the scars affects the outcomes as the erythema was significantly reduced in patients with mature scars than those with immature scars ⁽¹³⁾. Similarly, Manuskiatti et al. carried out a randomized clinical trial on 10 patients with previously untreated hypertrophic scars or keloids with skin types I-VI. The authors found out that 585nm PDL was successful in treating the study participants and that change in fluencies doesn't affect the results ⁽¹⁴⁾.

However, this observation hasn't remained uniform throughout the studies as a randomized, prospective, and single-blinded study reported no significant improvement in the characters of hypertrophic scars treated with PDL or silicone gel when compared with controls ⁽¹⁵⁾.

Our study also reported an equally significant role of erbium laser in the treatment of hypertrophic scar when

compared with the conventional method of corticosteroid injection. These results are also in line with earlier studies. For instance, Omnarifard and Rasti compared the efficacy of both PDL and Erbium lasers with steroids and found that both laser modalities were equally effective and superior in their role than that of intralesional steroids ⁽¹⁶⁾. In another study, fractional mode of erbium laser was compared with ablative mode and it was reported that ablative mode was significantly better in improving height, pigmentation, pliability, and vascularity of hypertrophic scars than the other evaluated technique ⁽¹⁷⁾.

The study is limited in terms of a shorter study period due to which long-term follow-up couldn't be achieved. Therefore, it is recommended to carry retrospective study to access the long-term effect of such treatment methodologies and to analyze how a change in steroid doses and laser fluencies can affect the outcomes.

CONCLUSION

Both pulse-dyed and erbium laser is significantly more effective than corticosteroid treatment in improving the Vancouver Burn Scar scale, vascularity, and height scores of hypertrophic scars.

Author's Contribution:

Concept & Design of Study:	Usman Jahangir Seemab Khan, Tooba Malik
Drafting:	Tooba Malik, Seemab Khan
Data Analysis:	Usman Jahangir, Seemab Khan
Revisiting Critically:	Usman Jahangir, Seemab Khan
Final Approval of version:	Usman Jahangir

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

- Peng GL, Kerolus JL. Management of surgical scars. *Facial Plastic Surgery Clinics* 2019;27(4): 513-7.
- Wang R, Danielsen PL, Ågren MS, Duke J, Wood F, Zeng XX, et al. Corticosteroid Injection Alone or Combined with Surgical Excision of Keloids versus Other Therapies Including Ionising Radiotherapy: A Systematic Review and Meta-Analysis of Randomised Controlled Trials. *Eur Burn J* 2021;2(2):41-54.
- Brewin M, Shokrollahi K. Pulsed Dye Laser Treatment for the Treatment of Hypertrophic Burns Scarring. *Laser Management of Scars*: Springer; 2020.p.43-6.
- Barchitta M, Maugeri A, Favara G, Magnano San Lio R, Evola G, Agodi A, et al. Nutrition and wound healing: An overview focusing on the

- beneficial effects of curcumin. *Int J Molecular Sci* 2019;20(5):1119.
5. Verne S, Magno R, Eber A, Perper M, Alomair I, Alfuraih A, et al. Lasers for Scars and Striae. *Pediatric Dermatologic Surg* 2019:197-206.
 6. Betarbet U, Blalock TW. Keloids: A review of etiology, prevention, and treatment. *J Clin Aesthetic Dermatol* 2020;13(2):33.
 7. Ojeh N, Bharatha A, Gaur U, Forde AL. Keloids: current and emerging therapies. *Scars Burns Healing* 2020;6:2059513120940499.
 8. Kuo YR, Wu WS, Jeng SF, Wang FS, Huang HC, Lin CZ, et al. Suppressed TGF- β 1 expression is correlated with up-regulation of matrix metalloproteinase-13 in keloid regression after flashlamp pulsed-dye laser treatment. *Lasers in Surgery and Medicine: Official J Am Society Laser Med Surg* 2005;36(1):38-42.
 9. Mofikoya BO, Adeyemo WL, Abdus-salam AA. Keloid and hypertrophic scars: a review of recent developments in pathogenesis and management 2007.
 10. Mahar PD, Spinks AB, Cleland H, Bekhor P, Waibel JS, Lo C, et al. Improvement of burn scars treated with fractional ablative CO₂ lasers—a systematic review and meta-analysis using the Vancouver Scar Scale. *J Burn Care Res* 2021; 42(2):200-6.
 11. Song WJ, Nam SM, Park ES, Choi CY, Lee SW. The effectiveness of early combined CO₂ ablative fractional laser and 595-nm pulsed dye laser treatment after scar revision. *J Craniofacial Surg* 2021;32(2):629-31.
 12. Rosenthal A, Kolli H, Israilevich R, Moy R. Lasers for the prevention and treatment of hypertrophic scars: a review of the literature. *J Cosmetic Laser Therapy* 2020;22(3):115-25.
 13. Chan HH, Wong DS, Ho W, Lam L, Wei W. The use of pulsed dye laser for the prevention and treatment of hypertrophic scars in Chinese persons. *Dermatologic Surg* 2004;30(7):987-94.
 14. Manuskiatti W, Fitzpatrick RE, Goldman MP. Energy density and numbers of treatment affect response of keloidal and hypertrophic sternotomy scars to the 585-nm flashlamp-pumped pulsed-dye laser. *J Am Acad Dermatol* 2001;45(4):557-65.
 15. Alster TS, Handrick C, editors. *Laser treatment of hypertrophic scars, keloids, and striae. Seminars in cutaneous medicine and surgery*; 2000.
 16. Omranifard M, Rasti M. Comparing the effects of conventional method, pulse dye laser and erbium laser for the treatment of hypertrophic scars in Iranian patients. 2007.
 17. Asfour A, Shokeir H, Alwakil T, Ghareeb F, Elbasiouny M. Evaluation of the efficacy of ablative vs. fractional Er: YAG laser modes as a treatment of post-burn scars. *Biol Med (Aligarh)* 2017;9(415):2.