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Different Treatment Modalities in Treatment of Hypertrophic Scar (Comparative study)

Sh.H.Abdel-Rahman, A.M.Hamed, M.S.Darwish
Dermatology, Venereology and Andrology Dept., Faculty of Medicine, Benha Univ., Benha, Egypt
E-Mail: happymoon991@yahoo.com

Abstract

Hypertrophic scars are dermal fibroproliferative disorders that typically develop after a skin injury heals. They can cause physical, psychological, and cosmetic problems. The management of such scars remains a matter of debate due to lack of effective treatment methods and the inability to prevent recurrences. The aim of this work is to assess the effectiveness of efficacy and safety of ND-YAG laser alone or in combination with intralesional injection of steroid. This prospective clinical study included twenty patients with hypertrophic scars divided equally in to two groups. All patients received Nd:Yag laser session once a month for three months with a follow-up period of six months. The second group recieved intralesional injection of steroid after each laser session. Therapeutic satisfaction of the patient and physician were recorded. Lesions were assessed for erythema, pigmentation, height and pliability using Vancouver Scar Scale as well as itching and pain.

Keywords: Hypertrophic scars, ND-YAG laser, Intralesional steroid.

1. Introduction

Hypertrophic scars are dermal fibroproliferative disorders that usually develop after skin injury heals. Patients often experience physical deformities, restricted range of motion, pain and pruritus. These scars are seen in about 50% of post-surgical wounds and in more than 50% of healed deep burns [1].

Numerous treatments are available such as surgical excision, intralesional steroid injection, radiation therapy, lasers and pressure therapy; none of which offer satisfactory therapeutic results [2].

The Nd-YAG laser emits light in the 1064 nm wavelength (near-infrared range), which is only moderately absorbed by melanin. Therefore, applying a black-colored film over the skin surface will help absorb most of the laser energy and vaporize the stratum corneum along with the removal of deep layers of the epidermis. Some heat is generated in the deep layers of the epidermis and superficial dermis showed persistent flattening of keloids or hypertrophic scars a reduction in the size of the scars .The Nd:YAG laser appears to improve the cosmetic appearance of keloids and may be a superior treatment modality than PDL lasers [3].

Corticosteroids, specifically intralesional injections, have been the mainstay of treatment. Corticosteroids reduce excessive scarring by reducing collagen synthesis, altering glucosaminoglycan synthesis, and reducing production of inflammatory mediators and fibroblast proliferation during wound healing [4].

2. Patients and methods

This study included forty twenty patients with hypertrophic scars who attended our dermatology outpatient clinic between May 2018 and November 2018. The study was assessed and approved by the institutional ethics committee. The procedure was explained to the patients and informed consent was obtained. All patients underwent history taking and clinical examination. Patients with hypertrophic scars who were not treated for hypertrophic scars at all were included in the study. Exclusion criteria were pregnancy, lactation, local infection, patients on retinoids or anabolic steroids, severe systemic disease, pre-existing neuromuscular disease. All patients were treated with laser therapy which was done by a 1064 nm long pulsed Nd:YAG Laser (Synchro HP) for one session per month for a maximum of three sessions. The following parameters were used: spot size 10 mm, fluence60 J/cm2, pulse duration 15 msec and frequency 0.5Hz⁄sec. The patients were divided into two goups; group A: treated with a course of three treatment sessions of Nd:YAG only,

group B: patients were treated with slow injection of triamcinolone acetonide (TAC) in concentrations of 20-40 mg/mL administered intralesionally with a dose of 2 U (0.050 ml) of insulin syringe(25- to 27-gauge needle) was injected per cm^2 area at three treatment sessions immediately after the ND-YAG laser session. At the 6^{th} month follow-up period, the overall assessment information was obtained and graded subjectively on Vancouver scar scale as follows; Vascularity: 0:normal , 1:pink, 2:red , 3:purple Pliability; 0:normal, 1:supple, 2:Yielding, 3firm or 4:ropes or 5:contracture.Pigmentation ; 0:normal, 1:hypopigmentation, 2:hyperpigmentation. Height; 0: flat, 1 :< 2mm, 2: 2-5mm or 3: >5mm.

The physician as well as the patient recorded this information. Improvement in pain and pruritus. During the six month follow-up period, the patients were monitored for the development of any complications such as pain, bleeding, edema, erythema, hypopigmentation, hyperpigmentation, secondary infection and recurrence.

3. Statistical Analysis

The data was analyzed using Statistical Package for Social Science version 20 (SPSS Inc., Chicago, IL, USA). Parametric data were expressed as mean ± standard deviation and nonparametric data were expressed as numbers and percentages of the total. Comparisons of the pre-treatment and post-treatment mean ± standard deviation were done using the paired *t*-test. A *P* value of $P \leq 0.05$ was considered statistically significant.

4. Results

The study enrolled 7 men and 13 women with a mean age of 11.2 ± 5.66 years. The mean duration of the hypertrophic scars was 11.6 ± 3.9 years, and the mean lesion size was 3.7 ± 1.4 cm Table (1) & Fig (1).

Table (1) Patient characteristics

	Mean±SD\frequency(proportion)
Age	11.2 ± 5.66
Gender: Female	7
Male	13
Cause:	
Trauma	6
Burn	8
Spontaneous	3
Surgery	3

Mann Whitney U test was used for age. Chi-square test was used for gender

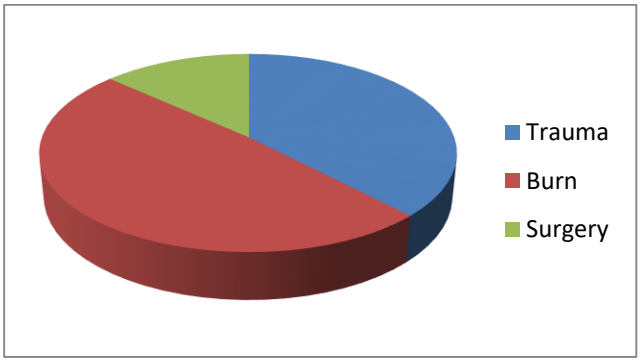

Fig (1) Causes of hypertrophic scar

There was significant improvement in all measured parameters of Vancouver Scale Score in all studied groups before and after treatment (p=0.001) except for vascularity in group I and pigmentation in all groups. There was a significant improvement in pruritus and pain Table (2) & Fig (2A&B).

Table (2) Impact of treatment on scar characteristics in all groups

	Group I			Group II		
	V1 (M±SD)	**V5 (M±SD)**	**P**	**V1 (M±SD)**	**V5 (M±SD)**	**P**
Vascularity	1.3±0.58	1.6±0.31	0.67	2.5±0.83	0.9±0.56	0.001
Pliability	2.3±0.42	1.1±0.43	0.001	2.9±0.87	1.2±0.42	0.001
Pigmentation	1.3±0.60	0.9±0.45	0.34	0.9±0.2	0.8±0.6	1
Height	1.3±0.41	0.9±0.77	0.001	2.1±0.59	1.4±0.55	0.001
Total score	6.8±1.4	4.2±0.87	0.001	8±1.44	4.2±1.31	0.001
Pain	3.6±1.15	2.30±0.56	0.007	3.6±1.99	1.9±1.3	0.005
Pruritus	6.1±1.33	3.5±1.33	0.011	4.86±1.85	1.7±0.9	0.006

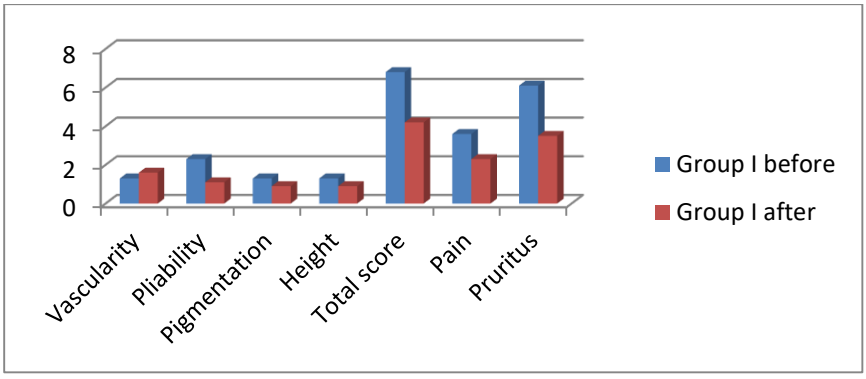

Fig (2.A) Impact of treatment on scar characteristics in group I (Nd-Yag laser).

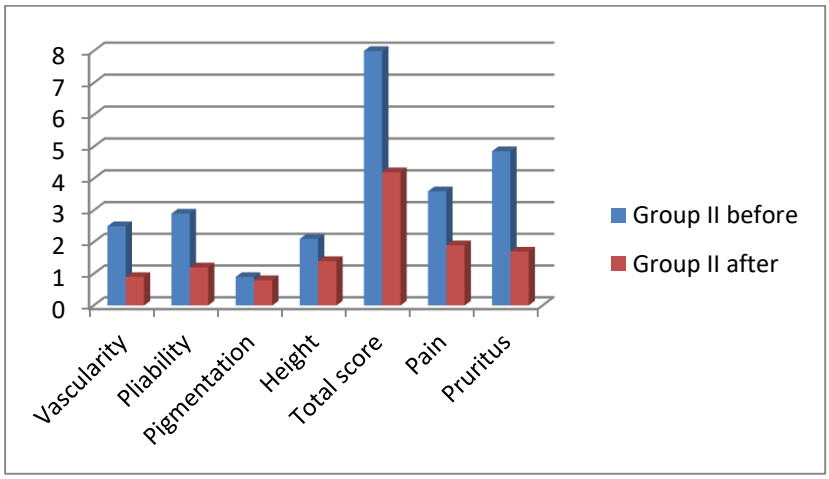

Fig (2.B) Impact of treatment on scar characteristics in group II (Nd-Yag laser+steroid).

5. Discussion

Scarring and its accompanying esthetic, functional, and psychological sequelae still pose major challenges. To date, there is no satisfactory prevention or treatment option for HS, which is mostly due to not completely comprehending the mechanisms underlying their formation.

The current study is a trial to evaluate the effect of Nd:YAG laser alone or in combination with intralesional injection of steroid in treatment of HTS. It included 20 patients with HTS; studied patients were randomly divided into 2equal groups.

One of the most important effects of Nd:YAG laser in treating HTS is that it generates heat, which initiates inflammation and in turn elevates vascular permeability, matrix metalloproteinase (MMP) production, and collagen fiber fascicle decomposition [5].

Accordingly, in this study, it was hypothesized that steroid can also be used for treatment of HTSs in combination with Nd:YAG laser, may be due to the synergistic therapeutic effect .

In the current study, a highly significant reduction in VSS was observed with Nd:YAG laser therapy. It was mainly derived from improvement in pliability, height and thickness. On the other hand, scar vascularity and pigmentation showed no significant improvement.

This comes in agreement with the results reported by *Koike et al. (2014)***,** who treated 102 patients with keloid and hypertrophic scars. They were treated every 3-4 weeks for 1 year with a long-pulsed 1064 nm Nd:YAG laser. The average total VSS of the keloid and hypertrophic scar region groups dropped significantly 1 year after they completed all sessions compared with basline (all $P < 0.05$) [6] .

In contrary, found a good improvement in vascularity; there were significant differences between the pre- and post-treatment scores (all $P < 0.05$). In this latter study, the duration of the treatment plan was longer (12 sessions) than ours (3sessions).

Intralesional corticosteroids were proved to induce keloid regression through many different mechanisms. First, they suppress inflammation by inhibiting leukocyte and monocyte migration and phagocytosis. Second, they are powerful vasoconstrictors, thus reducing the delivery of oxygen and nutrients to the wound bed. Third, they have an antimitotic effect that inhibits keratinocytes and fibroblasts, slowing reepithelialization and new collagen formation. Furthermore, they may reduce plasma protease inhibitors, thus allowing collagenase to degrade collagen [7].

In the current study, a highly significant reduction in VSS was observed with Nd:YAG laser therapy combined with intralesional steroid injection. It was mainly derived from improvement in vascularity, pliability, height and thickness. On the other hand, scar pigmentation showed no significant improvement.

This comes in agreement with the results reported by Kumar et al. (2000), who treated 17 patients, whose keloids had been previously treated by Nd:YAG laser, complete resolution and full flattening in seven patients were achieved only by intralesional TAC, following the laser procedures [8].

Furthermore Rossi et al. (2013), used a combined therapy of 300 μs 1064 nm Nd:YAG laser plus intralesional triamcinolone that proved to be more effective than corticosteroid alone in reducing thickness and erythema of the keloid scars [9].

Morelli Coppolaet al. (2018), found that the response to corticosteroid injection alone is variable with 50–100% regression and a recurrence rate of 33% and 50% after 1 and 5 years, respectively. Several kinds of laser treatments were reported to address keloids; however, laser therapy alone was burdened with a high recurrence rate. Better results were described by combining CO2, pulsed-dye or Nd: YAG lasers with TAC intralesional injections [10].

The comparison between the two combination groups was significant regarding the four variables of the VSS. Group II (steroid+ Nd Yag laser) showed higher extent of improvement in all scar characteristics than group I (Nd Yag laser). In this study, combined therapy showed more improvement than laser monotherapy in all scar characteristics except for pigmentation which showed very poor improvement in all groups.

Regarding the poor improvement of pigmentation in all studied groups, Azzam et al. (2016), also showed no

improvement in pigmentation with CO2 laser or verapamil when used as monotherapy [11]. Moreover, Saha and Mukhopadhyay (2012) reported no improvement in pigmentation with 5-FU treatment when compared with TAC in treatment of keloids [12]. Accordingly, a comprehensive counseling of the patient is recommended before tailoring his/her treatment protocol. If pigmentation is the main concern of the patient, he/she should be informed that none of the three protocols studied in the current report can provide satisfactory results.

In a trial to determine predictors of better response, we found no significant correlation between the site of the scar and the percentage of change of VSS after 6 months, similar to Haedersdal et al [13].

In this study, the two studied groups showed no adverse effects such as worsening of scars, infection, delayed healing, hypo- or hyperpigmentation.

The improvement was probably due to the synergistic therapeutic effect of Nd:Yag laser which act by getting absorbed by haemoglobin which produces heat and causes coagulation necrosis resulting in hypoperfusion and tissue hypoxia [14].

6. Conclusion

This study concludes that Nd:YAG laser followed by intralesional injection of steroid tended to show higher extent of improvement in all scar characteristics than Nd:YAG laser followed by intralesional injection of botulinum toxin type A, the difference is statistically significant.

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