



Correlation of outcome of scars with age and gender following Er YAG laser therapy

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Abstract

The scar is a fibrous tissue that bridges the discontinuity following any form of trauma after tissue. Although its an inevitable part of healing an abnormal scar can influence well beingness of the patient. Scar can cause physical or psychological difficulties to the patient, thus the prevention, as well as treatment of scars is vital. Beginning from the initial management there are many methods to manage a scar. In this article we will be focusing on Laser Therapy. Laser resurfacing using Er YAG laser is one method of management of scars that are widely used in western country but in India it is relatively a newer addition. There are many factors that can influence the scar formation. This study was conducted in a Tertiary care Institute in South India under the Department of plastic surgery. The aim was to find out if age and gender of the patients influence outcome of scars following Er YAG Laser therapy. There are studies evaluated the response of laser therapy based on the time of starting the therapy and location of the scar, but the data based on the outcome based on age and gender is few. A Total of 73 scars were included in the study with a follow-up period of 6 months.

Keywords: scar management, scar outcome, age, gender, Er-YAG laser

Introduction

The abnormal scar is a sequela following any form of trauma. The concern of abnormal scars compels patients to seek consultation from any plastic surgeon or dermatologist. The symptoms that bring the patient to medical care are, disfigurement, pain, pruritis and restriction of movement of dynamic parts like joints, neck, eyelids, lips. The symptoms, and signs of scars can be varying, based to their location, color, consistency, or size. And there many factors which can influence the scar formation, scar maturation like age, gender, severity of the trauma, time it took for the wound to heal etc. None of the treatment method available can completely avoid scars, but scars can be made better with treatment. There are many methods known for the prevention as well as management of scars and but there is no method of choice in managing the scars. Some of the commonly used methods for scar management are, scar massaging with emollients or local application preparations, silicone application either as gel or sheet, pressure garments, intralesional steroids, surgical scar revision, and Laser Therapy. In this article we are sharing the scar management using the Laser Therapy. Scar management using Lasers are available since many years but type of Laser and treatment methods are evolving and newer Lasers as well as Laser treatment protocols are getting introduced.

Laser used initially in scar management were CO₂ and Pulsed-dye laser, which were known for adverse effects. Due to which it was less preferred over newer Lasers which are equally effective and with lesser adverse effects. Er

YAG Laser therapy is one such treatment method.

In India Er YAG is a recent addition to the Lasers used for scar management, hence the data of the efficacy of the Er YAG in managing scars on Indian skin type is few. In this study, we have used the Er YAG for fractional ablative resurfacing of the post-trauma and burns scars and studied the effect of the Laser on outcome of the scar. Scar as well as patient parameters which can affect the outcome of the laser therapy were evaluated and, in this article, we share our experience of evaluating two such factors s which are known to influence the scarring, that is age and gender of the patient. The aim of the study was to evaluate if these two factors influence the response of Er YAG Laser therapy.

Materials and Methods

This study was conducted in the Department of Plastic Surgery at a tertiary care center. The departmental ethical committee approval as well as informed written consent was obtained from each patient for Er YAG laser therapy and clinical photography. The inclusion criteria were any post trauma scar which is well healed, in patients who are between the age of 18 to 60 years. Thus, a sample of 73 scars enrolled randomly, which included post-trauma, post-surgical and post burns scars. All the data related to the patient and scars were collected. The scars were evaluated twice during the study using the Vancouver scar scale scoring system, which included the following parameters and scores; vascularity (normal=0, pink=1, red=2, purple=3), pigmentation (normal=0, hypopigmentation= 1,

hyperpigmentation=2), pliability (normal= 0, supple=1, yielding=2, firm=3, banding=4, contracture= 5), and height (normal=0, <2 mm=1, 2~5 mm=2, >5 mm=3) and clinical photography. First assessment was done pre-treatment and next one month after the completion of the laser therapy. The laser therapy was given for four sessions each at one-month interval. Er: YAG Laser therapy using Twain 2940, Quanta System, Italy, in ablative as well as thermal mode, at a wavelength of 2,940nm, fluence was set to 1 to 2 J/cm², pulse width used was 300 microseconds using spot diameter of 4mm. During each session, two laser passes of 400 mJ in short pulse mode (pulse duration 0.30ms) and one pass of 800 mJ in long pulse mode (pulse duration 1 ms) were given.

The response of each scar after the completion of the fourth sitting of the Er YAG were compared and statistical analysis was done using IBM statistical software, SPSS Statistics version 27 (IBM Inc.). Normally distributed data were expressed as mean \pm SD. Data were expressed as median (interquartile range, IQR), when the assumption of normality was violated (Shapiro Wilk test, $P < 0.001$). Paired T-Test was used and wherever needed one-way repeated measure ANOVA was done to determine whether there are any statistically significant differences between the means of three or more levels of a within-subjects factor over time. A P value < 0.05 was considered statistically significant.

Result

The mean age of patients was 35.2 ± 7.8 (range, 18-50 years). The preprocedural and postprocedural Vancouver scar scale parameters are compared, and the response is plotted as graph. There was a significant difference in vascularity, pigmentation, pliability, and height after laser application (paired t-test, $P = 0.001, 0.006, 0.001, 0.001$ and 0.001 , respectively). All the scars responded well to the Er YAG therapy. There was no statistically significant change in response of Er YAG to scars based on age or gender.

Discussion

The scar is a fibrous tissue that bridges the discontinuity of the wound on healing [2]. Initially during the process of healing the wound gets a bridge of collagen fibers with a thin epithelium, forming an immature scar³. The process of wound healing comprises three phases, the inflammation phase which lasts for a few days, the proliferation phase lasting for few weeks, and the maturation phase can take several months or years. Abnormal scar like hypertrophic scars begin to develop 6 to 8 weeks after wound healing, it grows for 3 to 6 months, and then regress after 6 months⁴. An immature scar is red, raised, rigid, and hypopigmented, During the process of maturation the scar becomes pliable, flatter, less vascular and color is normalized. The difference between the normal scar, immature scar lies in the difference in their extracellular matrix composition. A normal scar when mature consists of 80% type-I collagen with 10-15% type-III and a minimal amount of type-V collagen. This composition is altered in an abnormal scar with an increased ratio of type-III to type-I collagen and abnormal scar consists of around 33% type-III, 10% type-V, and around 60% type-I collagen. Apart from the composition of the collagen, the arrangement of fibrils and interfibrillar space also is different in an abnormal scar compared to the normal mature scar. The cellular function of fibroblasts and keratinocytes is also altered in an

abnormal scar making them pro-fibrotic. The expression of cytokines is also altered in an abnormal scar. The balance between matrix metalloproteinase (MMPs) and tissue inhibitors of metalloproteinase (TIMPs) is altered and is moved towards the pro-fibrotic side. Transforming growth factor- β (TGF- β), connective tissue growth factor (CTGF), platelet-derived growth factor (PDGF), and insulin-like growth factor 1 (ILGF-1) are up-regulated, meanwhile interferon- α (IFN- α) and interferon- γ (IFN- γ) are down-regulated [5].

There are many methods known for management of scars like scar massage using emollients or topical preparations containing allantoin, heparin etc, silicone in the form of gel or silicone sheet application, pressure garments, intralesional steroids, surgical scar revision, and Laser Therapy. The first LASER machine was made in the year 1960 by Maimon, which was a Ruby laser. Dr. Leon Goldman a dermatologist is widely respected as the father of laser medicine. The first laser that was specifically designed for use in a medical condition was Pulsed Dye Laser (PDL), which was used first for the treatment port-wine stains. Since then, laser technology has evolved a lot with newer concepts of pulsed therapy, fractionated laser therapy, Q-switched mode, etc. being added to the list. The principle of any laser is photo thermolysis, which was proposed first by Anderson. Each laser has a specific target on which it acts, known as chromophore. The laser selectively acts on its chromophore and produces thermal ablation of the target tissue. Fluence, pulse width, spot size, and stacking are variables that are to be adjusted according to the individual requirements. The mechanism by which a laser affects scar remodeling is not fully known, but ablative fractional resurfacing may lead to the production of various cytokines and growth factors by stimulating a variety of not fully known cellular responses. Fractional photo-thermolysis produces controlled and limited dermal heating which triggers a cascade of events in which leads to normalization of the collagen genesis-collagen lysis cycle which thus influences the scar morphology.

The known factors which can influence the formation of hypertrophic scar development are age (young age), gender (female gender), skin type (dark skin), location of scar (neck or upper limb burns), multiple surgical procedures, > 3 weeks to healing, meshed skin graft use, and burn severity [6].

The present study was designed to find out if there is any difference in response to Er YAG Laser based on the known factors which influence the scarring. There are studies which found factors that influence the response to the Laser based on location and the time on initiating the Laser therapy. But aim of the study was to find out if there is any difference based on age or gender of the participants. Interestingly in our study we did not find any statistically significant difference.

Table 1: Age distribution of The Participants

Age Group	(n.%)
Less than 20	2(2.7)
20-30	31(42.5)
30-40	19(26)
More than 40	21(28.8)
Total	73(100)

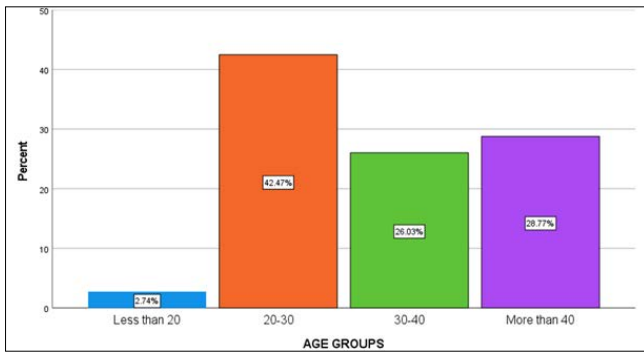


Fig 1: Graph Showing Age Distribution

Table 2: Showing Gender

Gender	(n, %)
Male	43(58.9)
Female	30(41.1)
Total	73(100)

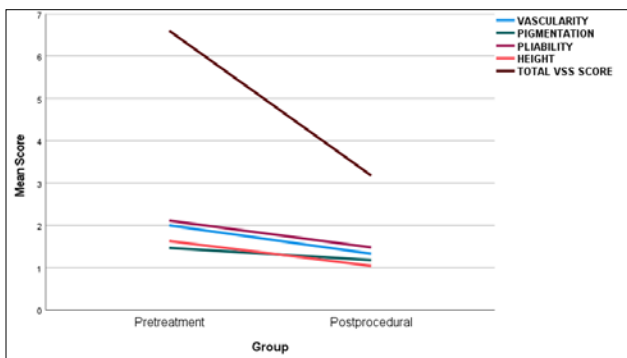


Fig 2: Graph of All participants of Pre and Post Er YAG laser



Fig 3: Setting of Er YAG Laser



Fig 4: Er YAG Laser Therapy Being Given

Conclusion

The study shows that Er -YAG Laser therapy is an effective in the management of scars. All the scars in the study showed good response to the Er YAG Laser Therapy and there is no statistically significant relation of age or gender with outcome of scar following Er YAG Laser Therapy. No adverse effects were noted during the study. The limitation of the study is that participants below 18 years or 60 years, were not included most of the scars were of maturation phase, many scars on the same individual were enrolled into the study, laser was given by a single specialist and follow up was for 6 months. We suggest large volume and multi-centre study and longer duration of follow up to get a better picture of the effect of Er YAG laser

Competing interest

None

Declarations

Author’s contributions

All authors made contributions to the article

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