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Research Article

Influence of Er:YAG Laser Irradiation on the Outcomes of Pliability of Donor Site Scar: A Case Report

Bharath Prakash [1] and Ravi Kumar Chittoria [2]*

[1]Senior Resident, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate, Medical Education and Research, JIPMER, Pondicherry.

[2]Professor, Head of IT Wing and Telemedicine, Department of Plastic Surgery & Telemedicine, JIPMER, Pondicherry, India.

***Corresponding Author:** Ravi Kumar Chittoria, Senior Professor and Associate Dean (Academic), Head of IT Wing and Telemedicine, Department of Plastic, Surgery and Telemedicine, JIPMER.

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Abstract

The scar is a sequela of any trauma, surgery, or burns. If the scar becomes unsightly it influences the psychological or physical well beingness of the patient. The vascularity status of the scar with the surrounding skin is one factor that can make the scar unsightly. There are many methods of scar management. Laser Therapy using Er YAG laser is one method of management of scars that are widely used in western countries. In India, the data on scar management using Er YAG laser and the effect of Er YAG laser on the pliability of the scar is few. This study was conducted in a tertiary care center in South India on a patient with donor site abnormal scar.

Key Words: scar management; scar vascularity; laser therapy; er-yag laser

Introduction

Human skin has three biomechanical features: strength, pliability (the ability to stretch) and elasticity (the ability to recoil). As scar matures, these properties change and the loss of skin elasticity appears to be the most prominent. Scar management is a very common problem for which patients seek consultation from any plastic surgeon. Abnormal scars can be painful, itchy and it can disable the patient as scars it can prevent the movement of the joint, neck eyelid, or lips. Scars can become unsightly due to their location, color, consistency, or size (height). There are many methods for the prevention and management of scars, Though the scars are not completely avoidable, they can certainly be made better with meticulous management of the wounds. There is no single best method to manage the scar. Some of the commonly used methods of scar management are scar massage with emollients, compressions garments, intralesional steroids, surgical scar revision, and Laser Therapy.

Laser therapy can be low level Laser Therapy as well as high level Laser therapy. High level laser therapy is in use for many years, initial lasers in use were CO2 and Pulsed dye laser. Due to the adverse effects, there is always a quest for newer and newer lasers that are equally effective and with lesser adverse effects and lesser downtime to achieve the desired clinical change. The desired clinical changes that can make a scar less unsightly are changes in size (height), consistency, color (pigmentation), vascularity.

Though the Er-YAG laser was used in western countries for many years, in India Er YAG is a relatively newer addition to the armamentarium in scar management, hence the data of the efficacy of the Er YAG in managing unsightly scars in Indian skin type is few. In this study, we have used the Er YAG for fractional ablative resurfacing of the donor site of split skin grafting scar and studied the effect of the Laser on vascularity parameter of vss score. The efficacy of the Laser on vascularity is studied in special interest as vascularity is one parameter that can attract a beholder's attention to any scar.

Materials and Methods

This study was conducted in the Department of Plastic Surgery at a tertiary care center after getting the departmental ethical committee approval. Informed written consent was taken from the patients for Er YAG therapy as well as the clinical photography. The details of the study are as follows: The patient was a 19-year-old male with no known comorbidities was admitted following RTA with soft tissue loss over dorsum of right foot. He underwent serial debridement of the necrotic tissue. He was managed with multiple sessions of wound debridement and negative pressure wound therapy. His wound gradually improved, and later raw area was covered with anterolateral thigh flap. the raw area over right thigh was covered with split thickness skin grafting from right thigh. (figure 1 and figure 2) The scar was evaluated twice

using the Vancouver scar scale scoring system and clinical photography twice once pre-treatment and next one month after the completion of the laser therapy. The laser therapy was given for one session. The laser used was Er: YAG Laser, Twain 2940, Quanta System S.p.A., 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 9mm. During each session, two laser passes of 400 mJ in short pulse mode (pulse duration 0.30ms) was used.

Figure-1: - recipient scar over right thigh and donor site scar over left thigh

Figure-2: - donor site scar over left thigh after laser therapy

Results

There was improvement in pliability of scar skin after Er YAG laser therapy both clinically and measured by VSS score. (figure 3)

Figure 3: -photo taken after 1 month after Er YAG laser therapy

Discussion

The scar is defined as fibrous tissue that replaces the wound after injury or disease.2 During the process of healing the wound develops a bridge of collagen fibers with a thin epithelium, forming an immature scar.3 An immature scar is red, raised, rigid, and hypopigmented, During the process of maturation the scar becomes more pliable, flatter, less vascular color is normalized. Any aberration of these makes the scar abnormal or unsightly. The difference between the normal scar, immature scar hypertrophic scar lies in the difference in the extracellular matrix composition, Type-III is the predominant type of collagen during the proliferation phase of normal wound healing and which eventually gets replaced with type-I collagen during the remodeling phase. 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. The 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 profibrotic. 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 profibrotic side. Transforming growth factor-ß (TGF-ß), connective tissue growth factor (CTGF), platelet derived growth factor (PDGF), and insulin-like growth factor 1 (ILGF- α) are up-regulated, meanwhile interferon α (IFN- α) and interferon- γ (IFN- γ) are down regulated.4,5

The first LASER machine was devised in 1960 by Maimon, which was a Ruby laser. Dr. Leon Goldman a dermatologist is considered to be 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 for 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 chromatophore. The laser selectively acts on its chromatophore 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 photothermolysis produces controlled and limited dermal heating which triggers a cascade of events in which normalization of the collagenesis-collagenolysis cycle occurs hyperpigmentation separately. Large volume and multi-center study may give a better picture of the effect of Er YAG laser.

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