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The Role of Erbium: YAG Laser in Prevention of Abnormal Scarring at Donor Site of Split Thickness Skin Grafting

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Abstract

Numerous revision procedures such as surgical excision, intralesional steroid injection, cryotherapy, dermabrasion, soft tissue augmentation, chemical peeling and laser therapy are available for the correction of various types of scars. Erbium:YAG lasers are successfully used to treat a variety of epidermal and dermal lesions, including rhytides, dyschromias, and certain types of scar. Recently we came across the usage of Erbium :YAG laser for the management of scar following the harvest of STSG.

Keywords: Er-YAG Laser; Donor site scar; Split thickness skin grafting.

INTRODUCTION

The scar over the amputation stump can sometimes be a problem in the rehabilitation of the patient. Scar tenderness, scar hypertrophy, scar contracture, ulceration etc are the common problems associated with scar over the amputation stump. Skin resurfacing with the use of laser therapy forms an important component of rejuvenation. An Er: YAG laser is a solid state laser whose active laser medium is erbium-doped yttrium aluminium garnet ($Er:Y_3Al_5O_{12}$) and typically emit infrared light of wavelength 2940 nm. This article assesses the use of Er: YAG laser as a means of improving wound healing outcomes following split thickness skin grafting.

MATERIAL AND METHODS

The study was conducted in The Department of Plastic Surgery in a tertiary care centreduring April 2021. Department Ethical committee clearance and informed consent from the patient were obtained. The patient was a 25-year-old male with no known comorbidities was admitted following RTA with soft tissue loss over dorsum of right hand. 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 a abdominal flap. The raw area over abdomen was covered with split

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thickness skin grafting from right thigh (*Fig. 1 and Fig. 2*). The patient's STSG donor sites were given Er YAG Laser therapy to improve the Stump. The settings used for the same was Er YAG 2490nm, Fluence 1, Pulse width 0.3MS, Tip 9mm. One pass of Thermal pulse of 400J .Total of 1 session were given .The scar was assessed with visual assessment and Vancouver scar scale score at before the beginning of the laser therapy and one month after the session.

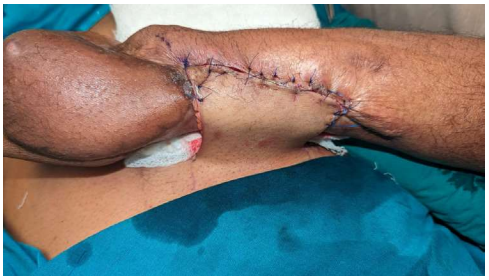

Fig. 1: Abdominal flap raised for defect in dorsum of hand

Fig. 2: Raw area over abdomen covered with ssg

RESULTS

The scar showed improvement inpigmentation. No complications were noted during the study. (*Fig. 3*)

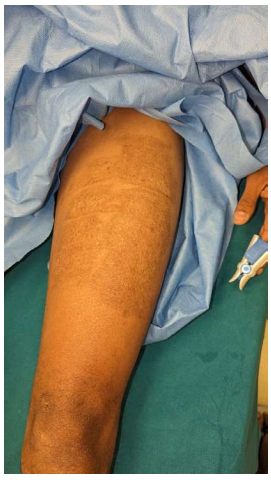

Fig. 3: Donor site scar after 1 month of ER.YAG laser therapy

DISCUSSION

A hypertrophic scar (HS) is a condition characterized by fibrosis with disordered collage deposition from skin fibroblasts[6] Major risk factors for HS formation include gender, age, genetic predisposition, immunological responses of the patient, type of injury, wound size and depth, anatomical site and mechanical tension on the wound.[7] HS formation is considered a result of the imbalance between ECM synthesis and degradation during wound healing.[8] Scar revisions with variable methods have been reported including pressure garment application, silicone sheet application, steroids, resection and radiation, botulinum toxin type A. No one treatment is effective in correcting all types of scars. Recently, carbon dioxide and Er: YAG laser resurfacing have been found to be safe and effective tools for scar revision.[9,10]

Skin resurfacing with the use of laser therapy forms an important component of rejuvenation surgery. The clinical use of lasers in plastic surgery was introduced by Anderson and Parrish in 1983 with the concept of photothermolysis.[1]At present, there are two laser wavelengths commonly used for skin resurfacing: pulsed carbon dioxide (CO_2) and erbium: yttrium aluminium-garnet (Er: YAG) laser. The wavelength of CO_2 lasers is not efficiently absorbed by water, so most of the energy is absorbed by the dermis thereby causingmore thermal necrosis.[2] Erbium-doped yttrium aluminum garnet (Er: YAG) lasers were developed as an alternative to the CO_2 lasers, catering to the main concern of excessive thermal damage to the skin.[3] Er: YAG lasers produce energy with a wavelength of 2940 nm, which is very near the peak absorption of water.[1] This wavelength has 10 times the water absorption of CO_2 lasers and a very short extinction. As a result, Er: YAG lasers deliver more efficient tissue ablation with minimal thermal damage, shorter recovery times, and lower incidence of side effects.[4] Another advantage of Er: YAG laser is the lack of requirement for recipient site anesthesia owing to minimal pain associated with the shots of Er: YAG laser.[7]

Some of the mechanisms by which they have a role in scar management include decreasing angiogenesis, improve the pliability and erythema of immature scar by destruction of small blood vessels by photothermolysis, decreased cellular activity due to laser-induced anoxia or through collagenolysis by laser stimulation of cytokine release.[8,9]

CONCLUSION

This report highlights the use of Er: YAG laser in the scar following amputation and was associated with better outcomes. Further studies are needed to allow for use on a large scale.

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