

Fractional ablative Er:YAG laser therapy in a patient with chronic recessive dystrophic epidermolysis bullosa: a case report and review of literature

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Recessive dystrophic epidermolysis bullosa (RDEB) is an autosomal recessive disorder that affects type VII collagen, one of the main components of the basement membrane. Patients present with non-healing chronic wounds in the body, extremities, and mucosal areas. There are many suggestive medical and surgical treatments, but most are ineffective. In this case, we discuss a new laser-assisted surgical protocol for these types of patients. A 54-year-old male patient was suffering from RDEB with large, excruciating, non-healing wounds on his extremities dating ten months, with no reasonable improvement, despite receiving intensive wound care. After ruling out other diagnoses (particularly malignancies), treatment was performed with a fractional Er:YAG laser for a single session. After four weeks of follow-up, the patient showed significant improvement, with no considerable complications reported. Fractional ablative Er:YAG laser could be an effective treatment option in RDEB patients. Clinical trials are required with long-term follow-ups for this novel treatment approach.

Keywords: epidermolysis bullosa, EB, Er:YAG laser, fractional ablative laser therapy, laser, review, therapy, treatment

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INTRODUCTION

Recessive dystrophic epidermolysis bullosa (RDEB) is an autosomal recessive disorder originating from mutations in COL7A1 encoding type VII collagen, a basement membrane component ¹. This rare inherited disorder is characterized by generalized skin fragility, severe blistering, and wounds, healing with mutilating scarring ².

The development of chronic wounds is a crucial health issue and a significant matter of morbidity and mortality in these patients, as they usually struggle with chronic non-healing wounds. Therefore, investigations concerning effective therapeutic approaches are ongoing, as the chronic nature of their wounds, along with an inadequate response to treatment, may lead

to aggressive metastatic squamous cell carcinoma (SCC) or sepsis ³.

To date, promising outcomes have been achieved by fractional ablative laser therapy (FABL) via collagen remodeling and acceleration in wound healing; however, evidence in this area is limited to a few case reports ⁴. The current report aims to present the successful outcome of FABL on a 54-year-old male patient with numerous RDEB lesions on his extremities.

CASE PRESENTATION

A 54-year-old male with RDEB presented with large, severely painful, non-healing wounds on his extremities dating ten months, with no reasonable improvement despite intensive wound care,

including petrolatum-based ointments, silver-impregnated dressings, and long-term oral and topical antibiotics.

Physical examination revealed several inflammatory ulcers approximately 5-7 cm in diameter and granulation tissue (Figure 1). The ulcerations had primarily been spotted as small erosions that not only did not respond to wound care products and protocols but gradually grew more significant with repetitive mechanical trauma. Nevertheless, no local infection was observed.

Initially, to rule out SCC, skin biopsies were taken. After eliminating skin malignancy from the diagnoses, the ulcerations and surrounding wound areas were treated using an ablative fractional Er:YAG laser (Asclepion Laser Technology, Germany). The laser therapy was exerted following topical anesthesia with lidocaine cream applied under occlusion for one hour and sublingual alprazolam (Xanax®). The anesthesia was supplemented intraoperatively with ice only.

The wound area was treated with a single pulse, non-overlapping technique, and scar reduction mode at a fluence of 20/cm², 1.5 s pause, and two passes. Conceptually, treatment density was reduced with increasing depth to prevent excessive thermal injury. Each session lasted about 20 minutes.

Immediately after laser treatment, a zinc oxide-based ointment was applied and continued 2-3 times a day. No postoperative complications were reported, and the patient resumed his normal activities and wound care strategies the next day. After four sessions with 1-month interval, a significant decrease in wound area was observed in each wound (Figure 1).

Objectively, the patient's wounds demonstrated near-complete re-epithelialization, and he reported relief from pain in the affected areas. He also felt better and more excited about participating in this novel treatment and was eager to continue the laser sessions. In Figure 1, you can see images of before and after therapy.



Figure 1. (a) Patient's face; (b) hand lesion before treatment; (c) dorsal foot lesion before treatment; (d) plantar foot lesion before treatment; (e) forearm lesion before treatment; (f) hand lesion after treatment; (g) dorsal foot lesion after treatment; (h) plantar foot lesion after treatment.

DISCUSSION

Chronic wounds remain a significant cause of morbidity and mortality for patients suffering from epidermolysis bullosa (EB). These wounds are often chronically painful and may cause tremendous anxiety, depression, and drug abuse. Wounds are often complicated by secondary infections and may cause multidrug-resistant infections with pathogens such as methicillin-resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa* ⁵.

The current study achieved promising outcomes after four sessions of FABL for controlling chronic RDEB wounds in a middle-aged male patient. Similar outcomes have been reported in other case reports.

Schneider and colleagues reported successful results following fifteen sessions of FABL plus topical poly-l-lactic acid. They achieved reasonable outcomes and improved quality of life and found a significant increase in the expression of collagen VII by immune staining of the biopsied specimens ⁴. Another study by Krakowski administered a session of 10,600-nm fractionated CO₂ lasers and revealed a 92% diminish in the size of RDEB lesion within the next month, and the second session of laser therapy led to re-epithelialization in the

second month ³. Hasegawa represented the next successful FABL in a four-year-old boy diagnosed with pseudosyndactyly as an RDEB-related complication that was treated micro-invasively using CO₂ laser under general anesthesia. Only four weeks were required to achieve the desired re-epithelialization. Due to the recurrence of the disorder, he underwent a repeated technique with no recurrence to date ⁶. In 2010, Minicucci *et al.* administered 660 nm, 100 mW power output, 2 J per point, and 35 J/cm² fluency to treat a non-healing wound in a four-year-old boy with RDEB. They performed six sessions using this approach, and their patient was satisfied with both pain relief and wound healing ⁷.

Collagen remodeling is the primary principle of FABL for the management of RDEB, leading to improved cosmesis and scar texture. The ultimate outcome of FABL, together with wound healing, is decreased wound fragility and less visible lesions, which improve the patient's self-esteem and quality of life ⁴. Microdebridement and neocollagenesis are the other probable mechanisms proposed for FABL to improve chronic RDEB wounds. The thermal effect of laser therapy probably induces the development of minuscule channels in the epidermis and superficial dermis, leading to microdebridement

Table 1. Laser therapy for the wounds of epidermolysis bullosa

Author	Gender/ Age (year)	Location	Treatment duration	Treatment sessions	Sample Size	Technique	Efficacy	Complication
Minicucci, 2010 ⁷	Child	Limbs and trunk	---	6	1	Low-level CO ₂ laser	90% reduction in wound surface area	N/A
Hasegawa, 2014 ⁶	M/5	Extremities and trunk	4 weeks	2	1	CO ₂ laser	100%	N/A
Galeotti, 2014 ⁹	M/8	Gingiva	6 months	1	1	Er:YAG laser	100%	N/A
Galeotti, 2014 ⁹	F/26	Gingiva	6 months	1	1	Er:YAG laser	100%	N/A
Krakowski, 2015 ³	M/22	Limb	4 weeks	2	1	Fractionated CO ₂ laser	92% reduction in wound surface area	N/A
Sindici, 2017 ¹⁰	4 Males & 3 Females	Oral cavity	6 months	1	7	Cord Blood Platelet Gel and Low-level Laser	100%	Unpleasant taste
Gholami, 2018 ¹¹	F/31	Gingiva	6 months	1	1	Er,Cr:YSGG laser and acellular dermal matrix allograft	Vestibular coverage 10 mm (95% coverage)	N/A
Schneider, 2019 ⁴	F	Neck	2 years	7	1	Fractionated CO ₂ laser	Overall significantly decreased size	N/A
Present report	M/54	Limbs	4 months	4	1	Er:YAG fractional laser	Near-complete healing	N/A

Abbreviations: N/A, not available; M, male; F, female.

and, in turn, collagenesis⁸. Furthermore, we assume that local heat, accompanied by better blood supplementation to the lesion site, washes out the inflammatory factors. This rehabilitates pain on the one hand and improves wound healing on the other. In Table 1, we have summarized the results of lasers therapy for EB wounds.

CONCLUSION

The use of FABL can appropriately improve RDEB in terms of healing, aesthetics, and pain relief, so it could be considered a successful laser-assisted surgical procedure for treating chronic EB wounds and ulcers. Further evaluations are required to achieve the most practical laser dose and number of laser therapy sessions for various types of wounds in different parts of the body. Nowadays, most studies about treatment of EB-associated wounds and ulcers are focusing on successful cell therapy methods¹². There are many studies on the beneficial effects of lasers in scars but concerning wounds like those of EB¹³⁻¹⁷. Hence, this study addressed the effects of laser on wounds and ulcers in an EB patient.

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