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ORIGINAL ARTICLE

Correction of cicatricial ectropion using non-ablative fractional laser resurfacing

Fabio Nicoli[1,2,3,4] · Georgios Orfaniotis[3,4] · Pedro Ciudad[4] · Michele Maruccia[4] · Davide Lazzeri[2,5] · Lorenzo Costabile[6] · Ke Li[5] · Yi Xin Zhang[5] · Valerio Cervelli[1] · Alberto Balzani[1]

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Abstract
Lower eyelid malposition is the most frequent and severe complication after blepharoplasty and ectropion is observed in 1% of patients after surgery. This article describes a non-surgical method to treat lower eyelid cicatricial ectropion using a non-ablative laser as an alternative to surgery. Twelve patients with unilateral or bilateral lower lid cicatricial ectropion, following surgery or trauma, underwent laser therapy from 2012 to 2016. Laser therapy was performed with a fractional non-ablative laser emitting at a wavelength of 1540 nm. Ten patients had a full correction of their ectropion and two patients had a partial recovery after laser therapy at 6-month follow-up visit. No serious adverse events were reported. Non-ablative fractional laser resurfacing can successfully treat cicatricial ectropion by remodeling the periocular scar tissue and improving the scar texture, and as such may be considered as a valuable alternative to surgery in selected patients.

Keywords Non-ablative laser · Blepharoplasty · Ectropion, laser, 1540, eyelid

Introduction

Blepharoplasty remains one of the most common esthetic procedures and is performed by a variety of surgical specialists. The complications of blepharoplasty are mostly minor and transient, however, rarely can cause permanent functional or esthetic adverse events [1, 2].

Lower eyelid malposition is the most frequent and severe complication after blepharoplasty [3]. Malposition can vary from a discrete lower eyelid retraction with scleral show to severe eversion causing ectropion. Ectropion is observed in 1% of patients after surgery, but some authors report rates up to 15–20% of scleral show and retraction following lower eyelid blepharoplasty [4, 5].

Ectropion is characterized by the eversion of the eyelid margin and exposure of the conjunctiva and the cornea [6]. Ectropion may be congenital or acquired, with the later subdivided into involutional, cicatricial, mechanical, and paralytic type [4–6]. Etiology is variable and can be multifactorial. Slackened tissue is responsible for hypotonic ectropions (involutional and paralytic forms), whether a tissue scarring and retraction is responsible for cicatricial ectropions [6]. Depending on the cause and severity, treatment of ectropion may involve a surgical or a non-surgical approach [7].

A number of surgical procedures have been described for ectropion correction including Z-plasty, skin graft, skin or muscle flap, and tarsal strip or fascial sling [7–10]; however, less-invasive methods are also available when surgery is not indicated due to medical co-morbidities or patient desire.

Fabio Nicoli, Georgios Orfaniotis, and Alberto Balzani equally contributed to this work.

✉ Fabio Nicoli
dr.fabionicoli@gmail.com

✉ Ke Li
18817821624@163.com

[1] Department of Plastic and Reconstructive Surgery, University of Rome "Tor Vergata", Tor Vergata, Rome, Italy

[2] Plastic Reconstructive and Aesthetic Surgery Unit, Villa Salaria Clinic, Rome, Italy

[3] Department of Plastic and Reconstructive Surgery, Guy's and St Thomas' NHS Foundation Trust, London, UK

[4] Department of Plastic and Reconstructive Surgery, China Medical University Hospital, Taichung, Taiwan

[5] Department of Plastic and Reconstructive Surgery, Shanghai Ninth People's Hospital, Shanghai JiaoTong University School of Medicine (China), 639 Zhi Zao Ju Road, Shanghai 200011, China

[6] School of Medicine, University of Perugia, Perugia, Italy

Topical injection treatment with fat or hyaluronic acid have been proposed [11–13], with partial success and poor cosmetic outcomes [14].

Recent advances in laser technology applied to the periorbital area and the ability of new devices to remodel surgical scars have played a key role in introducing a new conventional method to treat ectropion and complications of blepharoplasty [15–18].

This article describes a non-surgical method to treat lower eyelid cicatricial ectropion using a non-ablative laser as an alternative to surgery.

Although the effects of dermal contraction and scar remodeling following non-ablative or ablative laser resurfacing have been very well known, it is the first time these effects have been utilized in the treatment of cicatricial ectropion.

Methods

Twelve patients with unilateral or bilateral lower lid cicatricial ectropion, following surgery or trauma, underwent laser therapy from 2012 to 2016 in the Department of Plastic and Reconstructive Surgery at the University of Rome "Tor Vergata."

The assessment started at least 6 months after the evidence of firm ectropion, with evaluating the symmetry of the lower eyelids, related to the position and width of medial and lateral canthal tension. Subsequently, examination involved the snap-back test, the pinch test, and the distraction in order to determine lid laxity in three directions (vertical, horizontal, and sagittal). Mild lid laxity was detected in all patients. No patient had significant lid laxity, and the lid eversion was caused by a tethering of the anterior lamella.

The study was conducted in accordance with good clinical practices and with the Declaration of Helsinki 2000. The study was approved by the local research ethics committee and informed consent was obtained before the procedure and digital image production.

Laser technique

The laser therapy sessions were performed by the same plastic surgeon (A. B.) for all patients. Laser therapy was performed with a fractional non-ablative laser (StarLux ™ − 300; Palomar Medical Technologies, Burlington, MA, USA), consisting of an active erbium:glass rod attached to a xenon flash, emitting at a wavelength of 1540 nm. Patients wore protective metal eye shields before starting the procedure. Treatments were performed with a 10-mm fractional hand piece (Lux; Palomar Medical Technologies) (100 microbeams/cm^2; each microbeam has a diameter of approximately 0.1 mm; pulse duration 15 ms; energy 40–60 mJ/microbeam), using 3–4 passes, with the lowest energy used for the first treatment, increasing 5–10 mJ/microbeam with subsequent treatments depending on the scar tissue features, clinical outcomes, and patient tolerance (Fig. 1). The total average radiant exposure delivered ranged from 20 to 40 J/cm^2, depending on the energy level and number of passes used.

An integrated internal self-calibrating irradiation system monitored the energy used at the beginning of the study and was repeated twice during the treatment period. No anesthetic was used, but cooled ice packs were applied immediately after the treatment to reduce discomfort. A corticosteroid cream Advantan-Methylprednisolone Aceponate—0.1% 20 g (Intendis S.p.A., Milan, Italy) was applied topically 1 h after laser therapy, and it was continued for a course of 5 days. A Stearyl glycyrrhetinate soothing cream (Neo-Tec; NeoEurope

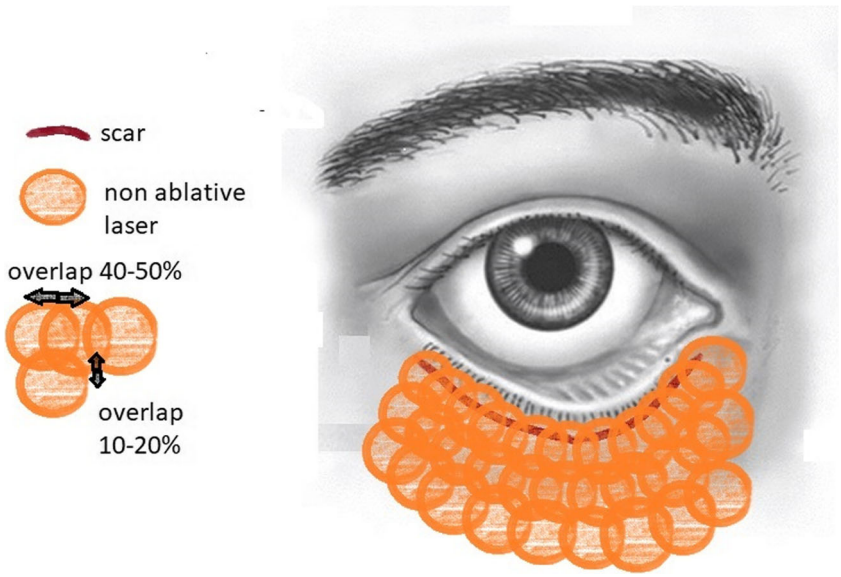

Fig. 1 Treatments were performed with a 10-mm fractional hand piece overlapping every shot in horizontal for 40–50% of the width and in vertical for 10–20%, covering all the periorbital area involved in the scarring tissue

Table 1 Patient assessment at 6-month follow-up

	Patient	Age (years)	Sex	Fitzpatrick skin type*	Lid	Prior lid surgery	Post laser correction	Complications
	1	63	F	II	LLL	Yes	Full	None
	2	41	F	II	RLL	Yes	Full	None
	3	28	F	II	RLL	No	Full	None
	4	62	M	II	RLL	Yes	Full	None
	5	71	F	II	LLL	Yes	Partial	None
	6	39	F	I	LLL	No	Full	None
	7	56	F	II	BLL	Yes	Full	None
	8	61	F	I	RLL	Yes	Full	Prolonged erythema
	9	67	M	II	RLL	Yes	Full	None
	10	56	F	II	RLL	No	Partial	None
	11	52	M	II	RLL	Yes	Full	None
	12	42	M	II	LLL	No	Full	None
Total	12	53.2 (mean); 28–71 (range)	8 F; 4 M	2 I; 10 II	7 RLL; 4 LLL; 1 BLL	8 yes; 4 no	10 full; 2 partial	1

M, male; *F*, female; *RLL*, right lower lid; *LLL*, left lower lid; *BLL*, both lower lids

*All patients were Caucasian

S.r.l., Rome, Italy) was used to improve skin regeneration, and a hyaluronic acid moisturizing gel (Neo-Tec; NeoEurope S.r.l.) was prescribed for daily application.

Radiant exposure, pulses, and number of treatment sessions were determined according to scar characteristics, patient's preference, and operator's experience. The patient's sensation of heat and physician's evaluation of erythema and dermal heating were used to guide treatment intensity and to prevent injury, augmenting the pulse width gradually as the radiant exposure energy increased appropriately.

Laser therapy was performed every 4 to 6 weeks for a total of five–six treatments and duration of the procedure lasted maximum 6 months or until patients were satisfied with the cosmesis and correction of the ectropion.

Tissue response and adverse events were recorded immediately before and after, each treatment, and 6 months after the session. The primary immediate endpoints for treatment included erythema and slight edema and in the next follow-up appointment, each patient was assessed for evidence of residual thermal injury and pigmentation changes. After completion of laser therapy, patients were assessed to record any improvement of ectropion. Completion of laser therapy was defined as an acceptable correction of the cicatricial ectropion as deemed by the patient.

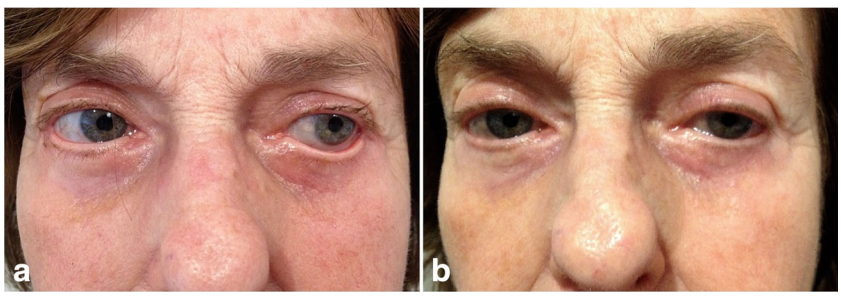

Fig. 2 A 63-year-old woman with left lower lid cicatricial ectropion after blepharoplasty (**a**). The patient after 6 months of fractional laser treatment, with full correction of her ectropion (**b**)

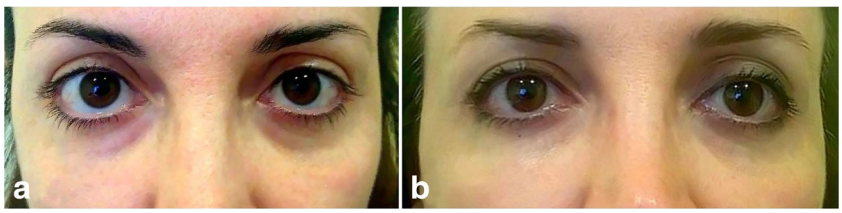

Fig. 3 A 41-year-old woman with right lower lid cicatricial ectropion after blepharoplasty (**a**). The patient after 6 months of fractional laser treatment, with full resolution to her ectropion (**b**)

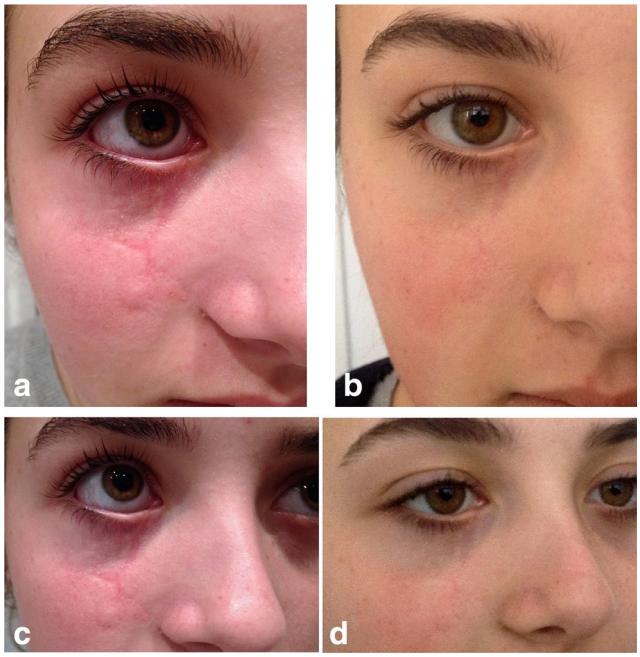

Fig. 4 A 28-year-old woman with right lower lid cicatricial ectropion post traumatic with pulled down lid and periocular scar. Frontal view (**a**) and three-quarter view (**c**). The patient more than 1 year after laser treatment, with full correction of her ectropion and improvement of her periocular scar (**b**, **d**)

Results

Twelve patients were enrolled with average age of 53 years, (range 28–71). There were eight women and four men, followed up for at least 6 months. All patients were Caucasian with fair skin (two patients Fitzpatrick type I and ten patients type II). Seven patients reported ectropion of the right lower lid, four of the left lower lid, and one bilateral. The prevalent cause was previous surgery (eight patients of which six blepharoplasties, one excisional biopsy, and one cancer excision) and four patients had a traumatic scar.

Ten patients had a full correction of their ectropion and two patients had a partial recovery after laser therapy. Table 1 summarizes the results at 6-month follow-up visit. No serious adverse events were reported. Patients reported erythema and swelling of the treated area for 2–3 days. One patient reported prolonged erythema which was resolved within 4 weeks with no sequela, treated with corticosteroid and moisturizing creams. There were no events of pigmentary changes or scarring. Participants reported occasional minor to moderate discomfort during the treatment.

The outcomes evaluated by the surgeon and nursing staff were found to be excellent, and patient satisfaction was valued as high. Representative photographs are shown in Figs. 2, 3, 4, and 5. Post treatment follow-up was satisfactory for all cases with no ectropion recurrence and no need for further additional treatment.

Discussion

Cicatricial ectropion is not only a challenging condition for the surgeon but also a distressing situation for patients who suffer with chronically irritated red eyes caused by the lower lid eversion.

Surgery is considered to be the gold standard for correction of ectropion and many surgical procedures have been developed including lateral canthal ligament division or resection, wedge tarsectomy, Z-plasty, skin graft, local flaps, cartilage graft, fascial or tarsal slings, and combined procedures [7–10, 19, 20].

However, not infrequently, these techniques are associated with a number of complications, which have a negative effect on outcome, and for this reason, novel techniques have been emerged [8]. Furthermore, some patients prefer non-surgical options often in view of previous unsuccessful blepharoplasty or are not suitable for surgery due to associated co-morbidities.

For those reasons, over the last decades, some non-surgical techniques have been described. Fezza JP [13] reported the treatment of lower eyelid cicatricial ectropion using injectable hyaluronic acid. On 15 patients, he reported a dramatic and immediate correction of their ectropion after injection of 1 cc of hyaluronic acid into the affected lid. However, following the same technique, Romero R et al. [14] demonstrated that only three patients (27.3%) had total correction after injection, while the correction was partial in the other eight patients (72.7%). They also observed a lumpiness incidence of 63.7% that was reported as an unacceptable cosmetically result.

The last decade laser therapy has been proposed as an alternative method in the management of scars of specific types and anatomical areas concerned [21]. There are

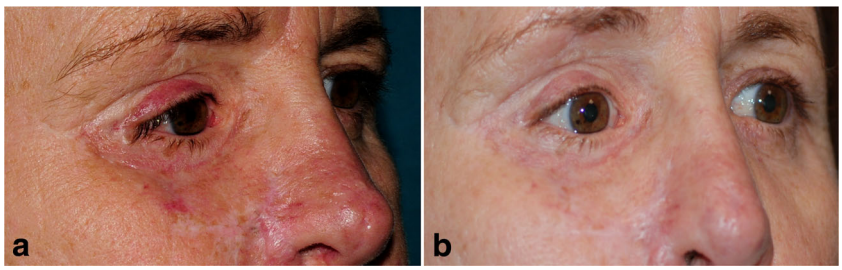

Fig. 5 A 56-year-old woman with right lower lid cicatricial ectropion after trauma (**a**). The patient after 6 months of fractional laser treatment, with partial resolution to her ectropion (**b**)

various lasers available for treatment of dermatologic conditions but very few of them have been utilized in clinical situations such as eyelid disorders [16]. We previously described the use of fractional ultra-pulse CO2 laser for the treatment of upper eyelid dermatochalasis [15], and Babucco reported positive results using a similar laser to correct entropion [17]. Sukal et al. [21] utilized non-ablative laser resurfacing to improve eyelid aperture and eyelid tightening. Although there are still some doubts remaining on the real evidence of skin tightening after fractional non-ablative laser treatment; histologically, it was noted that in non-ablative laser-treated skin, regenerated collage arranged in parallel alignment to the epidermis [22]. In fact, the fractional non-ablative laser resurfacing is able to remodel the scar and produce long-term collagen remodeling through several mechanisms [22, 23]. The non-ablative laser has a unique thermal pattern with columns of thermal damage at specific depths [23]. The thermal effect stimulates a therapeutic wound healing response with heat shock proteins, myofibroblasts, and an increased collagen III production and thereby, raises a potential for texture remodeling [24, 25].

In our study, the remodeling potential has been utilized to treat the cicatricial ectropion. Ten of our 12 patients had a full ectropion correction after laser treatment and only two a partial recovery with a minor complication registered. No patient required surgery. The results are as good as reported with surgical correction, without the need for surgery or down time. The data presented here establish the first substantial evidence that cicatricial ectropion can be remodeled from fractional non-ablative laser treatments. Due to the promising results achieved using laser for the treatment of cicatricial ectropion, it may be possible to expand this concept to treat involutional ectropion although a lid-tightening or further surgical procedure may ultimately be essential in this type of entity.

The present method can be a valid option as an alternative to surgery but could also be combined with surgery and does not preclude any operative treatment should be required in the future. In addition, laser could be used in synergy with other non-operative techniques such as injection of hyaluronic acid, platelet rich plasma, or fat transfer [11–13, 26]. Limitations of the study include the small number of cases and the fact that it was not randomized. However, the results at long-term follow-up are positive. To the best of our knowledge, this is the first report of non-ablative laser to treat lower lid cicatricial ectropion.

Conclusion

Non-ablative fractional laser resurfacing can successfully treat cicatricial ectropion by remodeling the periocular scar tissue and improving the scar texture, and as such may be considered as a valuable alternative to surgery in selected patients. Although stronger evidence with further controlled and histological studies is required, this method is easy to perform with minimal patient discomfort and, in this small case series, was noted to be safe and effective.

Compliance with ethical standards

Conflict of Interest The authors declare that they have no conflict of interest.

Informed consent Informed consent was obtained from all individual participants included in the study.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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