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ORIGINAL ARTICLE NON-SURGICAL AESTHETIC

Treating Excess Lower Eyelid Skin Without Incisions

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Abstract

Introduction Periocular rhytids and dermatochalasis are common and striking signs of facial aging. The CO_2 laser technique described herein addresses Hester classification type I, aging at the level of the lower eyelid, focus on the treatment of the dermatochalasis.

Materials and Methods In this retrospective study of patients undergoing treatment at our clinic between 2000 and 2018, 263 were classified as Hester I and CO_2 laser therapy was the treatment to improve the local rhytids.

Results Improvement in dermatochalasis was found in all patients, resulting in better rejuvenation of the target area while eliminating visible scarring from a suture through the skin.

Discussion In our experience, CO_2 laser functions as a substitute for transcutaneous lower blepharoplasty, due to the fact that the contracture of the skin renders resection of that skin unnecessarily, thus avoiding the tell-tale scalpel incisions under the lashes.

Conclusion The quality of the results of this retrospective study allows us to offer this laser therapy to treat lower eyelids classified as Hester I.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Laser · CO_2 laser · Blepharoplasty · Eyelid · Resurfacing

Introduction

Periocular rhytids and dermatochalasis are common and striking signs of facial aging [1]. Over time, progressive changes occur in these structures, altering the balance between them, modifying volume, position and consistency [2]. In 2007, Lambros presented on the stability of the palpebro-malar structures based on a photographic study. It explains the local aging process as an alteration in soft tissues and protrusion of the fat pads of the lower eyelid, aggravated by the increasing shadowing between them [3].

In 1961, Loeb coined the term "nasojugal sulcus" to define the change between the lower eyelid and the medial portion of the malar region. The term "tear trough" was created by Flowers in 1969 to describe the same anatomic feature [4, 5].

The lower eyelid compounds part of the mid-face, where the upper border is delimited by the outer corner of the eye and the lower border by the border of the lip.

The different degrees of aging for the mid-third face were systematized by Hester in 2000. On his classification, Type I aging at the level of the lower eyelid with dermatochalasis is that we consider indicated for treatment with a CO_2 laser with the technique described herein [6].

Over time, the collagen and elastin of the periorbital region suffer a degeneration induced by age and ultraviolet exposure. Another contributing factor is the release of collagenase from the damaged epidermis. With the use of

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the laser, there is remodeling of the dermis, resulting in remodeling and regrowth of new, compact collagen and normally organized elastin. Histological studies indicate an increased horizontal orientation of neocolagenesis and neoelastogenesis occurring in the papillary and reticular of the dermis for at least 18 months after the use of the CO_2 laser [1].

The treatment of the aging lid is complex, and it is first a matter of careful clinical evaluation for the best choice of treatment technique [7]. This treatment can be non-surgical, such as with a CO_2 laser, alloplastic or autologous fillings [8–12]. When surgically treated, this may be done with either transcutaneous [7, 13–18] or transconjunctival incisions [7, 19–22].

For nearly a quarter of a century, the CO_2 ablative laser has been the gold standard for cutaneous resurfacing. Using 10,600 nm wavelength, the CO_2 laser has water as its target. The water in the tissue absorbs this energy, which leads to vaporization of the water, induction of the contraction of collagen by heat, cutaneous contraction and subsequent neocollagenesis. The concept of photothermolysis revolutionized laser surgery by achieving a specific performance of the receptive chromophore with little repercussion in the surrounding tissue [10, 23, 24].

CO_2 laser treatment improves the signs of periorbital aging by eliminating in most cases the need for transcutaneous blepharoplasty with skin resection and consequent lower eyelid scarring. In this paper, we present a series of cases of Hester Type I patients treated with a CO_2 laser in the lower eyelid.

Methodology

This retrospective study was done using the Mirror® clinical imaging software, limiting the search to cases from 2000 to 2018. Using the search criteria "lower blepharoplasty," 373 patients were identified. With the criteria "partial CO_2 resurfacing of the lower eyelid," 173 patients were identified from an initial universe of 546 patients with eyelid treatment.

In our protocol, Hester I patients require only CO_2 laser treatment, focusing on the dermatochalasis. Hester II patients require transconjunctival blepharoplasty with a replacement of fat pad and CO_2 laser if dermatochalasis. Hester III and IV patients require middle-third endoscopic lifting [9, 25].

A review of charts was performed for classification and search of patients who underwent only the CO_2 laser as a treatment for dermatochalasis (Hester I classification). A total of 283 patients were excluded for several reasons, the most common reason being a loss of follow-up, incomplete or duplicate data and associated transcutaneous or transconjuctival procedures.

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

From the patients remaining in the study, 263 were classified as Hester I and, therefore, treated only with CO_2 laser for the lower lid region.

Description of Technique

In our experience, patients classified as Hester I—aging confined to lower lid, pseudoherniation of orbital fat and minimal skin/muscle excess—need resurfacing with CO_2 to treat dermatochalasis. An associated procedure such as fat grafting can be indicated. We believe that the focus on Hester I patients is to treat the dermatochalasis.

Topical anesthesia is applied using Pliaglis® (lidocaine + tetracaine) or local anesthesia with sedation (most common). Assessment is made regarding the need for prevention of the herpes virus. In the case of a positive history, treatment is initiated on the day of the procedure with Penvir® (famciclovir) 125 mg 12/12 h for 7 days.

From 2000 to 2012, treatment of dermatochalasis in patients with Hester I was performed with an ablative procedure using the Coherent CO_2 UltraPulse® laser using 300 mJ of energy with a maximum of two passes in the palpebral region in a lateral orientation using a density of 5 or 6, corresponding to an overlap of 30–35%.

After the invention of the fractional CO_2 laser, procedures were performed starting in 2012 with the Alma® brand Pixel device with a skin resurfacing setting of 60 mJ/pixel, 0 mm of spacing and a "Medium" power setting. The goal was to have a non-fractional setting (ablative) in a fractional-capable laser. Four-to-six passes were made with the laser (both horizontal and vertical orientation) according to the clinical evaluation. Care must be taken to avoid damage to the palpebral tarsal plate, and in our practice, we use a movable metallic instrument to protect the tarsal plate and the globe of the laser shots.

After applying the laser, a 3% Tensine mask dressing is applied, which will be removed 5–7 days after the procedure facilitated by the use of collagenase 0.6 U/g. The tension mask helps reduce postoperative pain and discomfort. Pruritus was a common complaint before the introduction of the 3% Tensine mask.

Skincare following CO_2 laser treatment is based on the patient's Fitzpatrick skin type scale. We believe that there are different results based on the patient's Fitzpatrick scale. Therefore, the care for those with a high classification should be higher, especially for those with a chance of dyschromia. In the first 3 weeks after removing the 3% Tensine mask, the morning protocol includes: washing and

hydrating the skin and sunblock applied every 3 h, using a product with a chemical protection factor of 15 and a physical block of titanium dioxide. At night, repeat cleansing and hydration. Skincare plays a key role in avoiding complications in laser therapy.

After the first weeks, Vitamin C serum is added in the mornings and at night and a bleaching cream based on Fitzpatrick skin type (Table 1). After applying the bleaching cream, a fine layer of Cerasomosides is applied by the patient. Cerasomosides has a calming effect and enhances the effect of retinoic acid.

Results

From 2000 to 2018, 263 lower eyelid rejuvenations were performed using the CO_2 laser alone, without cutaneous incisions in patients classified as Hester I. Most patients (90.8%) were female.

Associated procedures were: endoscopic forehead lift (browlift) 41% (108), upper blepharoplasty 38.4% (101), facelift 29.6% (78) and facial fillers (autologous or not) 27.3% (72).

Average surgical time for the CO_2 laser procedure was 5 min per side. With our protocol, most patients need just one CO_2 laser procedure for improvement in the eyelid area. Pre- and postoperative photographs were presented for comparison (Figs. 1, 2, 3, 4, 5, 6 and 7).

The CO_2 laser treatment can also be indicated for Hester II–IV patients that have medical or personal contraindications to other procedures (transconjuctival blepharoplasty or middle-third endoscopic lifting), giving a good improvement in the target area. These patients were not included in the study (Figs. 2 and 7).

Table 1 Skin lightening cream (skin care)

Fitzpatrick skin type	I and II (%)	III and IV (%)
0–2nd month	Retinoic acid 0.025	Glycolic acid 8
	Hydroquinone 4	Kojic acid 1.5
	Dexamethasone 0.05	Hydroquinone 2
		Dexamethasone 0.05
		Aloe vera 10
2nd–4th month	Retinoic acid 0.05	Glycolic acid 15
	Dexamethasone 0.05	Kojic acid 2
		Hydroquinone 5
		Dexamethasone 0.05
4th–6th month	Retinoic acid 0.1	Glycolic acid 15
	Dexamethasone 0.05	Kojic acid 2
		Hydroquinone 5
		Dexamethasone 0.05

Fig. 1 **a** A 39-year-old preoperative female patient. **b** Postoperative 1 year and 10 months (Laser Coherent CO_2 UltraPulse®). Associated with superior blepharoplasty and endoscopic frontoplasty

Fig. 2 **a** A 74-year-old preoperative female patient. **b** Postoperative 7 months (Laser Coherent CO_2 UltraPulse®)

Fig. 3 **a** A 45-year-old preoperative female patient. **b** Postoperative 5 months (Laser Coherent CO_2 UltraPulse®). Associated with endoscopic frontoplasty

In our series, there were only two contraindications for the treatment of dermatochalasis of the lower eyelid with

Fig. 4 **a** A 48-year-old preoperative female patient. **b** Postoperative 5 months (Alma CO_2 Pixel®). Associated with superior blepharoplasty and endoscopic frontoplasty

Fig. 5 **a** A 49-year-old preoperative female patient. **b** Postoperative 5 months (Alma CO_2 Pixel®). Associated with endoscopic frontoplasty

Fig. 6 **a** A 48-year-old preoperative female patient. **b** Postoperative 5 months (Alma CO_2 Pixel®)

Fig. 7 **a** A 72-year-old preoperative female patient. **b** Postoperative 1 year (Alma CO_2 Pixel®). Associated with pan facial fat grafting

CO_2 laser. The first was for Asian patients, due to the difficulty in the management of cutaneous hyperpigmentation after laser therapy. The second contraindication was the presence of festoons since this implies the impairment of the orbicularis musculature, which should be properly addressed to improve the patient's aesthetic profile.

The result of the procedure was an improvement in the eyelid area, with a contraction of the complex epidermis/dermis, resulting in an eyelid with fewer rhytids and a younger appearance, evaluated by the physician (original surgeon) in 6 months postoperative with physical examination and photographic documentation.

The main postoperative intercurrence is transient erythema, presented by all patients. It is important to explain this postoperative aspect to the patient. Complications are summarized in Table 2 (postoperative complications). There was no difference in complications with the change

Table 2 Postoperative complications

Recurrence of wrinkles	15.6% (41)
Milia	15% (40)
Hyperpigmentation	15% (40)
Allergy	11.8% (31)
Synechia	2.2% (6)
Hypopigmentation	7.9% (21)
Activation of acne	4.9% (13)
Transient ectropion	0.76% (2)
Scarring	0.38% (1)
Pain	0
Herpes	0
Fungal infection	0
Permanent ectropion	0
Lesion of cornea and/or ocular globe	0

in the laser equipment because we use the fractional laser in a non-fractional setting (ablative mode).

Postoperative pruritus was a common patient complaint. The Tensine mask helped in the evolution of this aspect. There was an improvement in patient comfort after its use, limiting or almost eliminating this symptom.

Recurrence of wrinkles was evaluated by a physician 6 months after the procedure. It is necessary to wait for the postoperative edema to evaluate the result accurately. The stimulation of the muscles of facial expression is the factor of creation of these wrinkles. When the recurrence of wrinkles was diagnosed, patients were evaluated for potential botulinum toxin to cease the causative factor or for a new CO_2 laser session if deep wrinkles, which occurs in less than 10% of cases of recurrence. We do not consider recurrence as a failure of treatment as we always found improvement in the eyelid and tear trough area.

No patient has evolved to transcutaneous lower blepharoplasty.

Discussion

In our experience, the CO_2 laser functions as a substitute for transcutaneous lower blepharoplasty skin resection. This is because the contracture of the skin renders resection of that skin unnecessary, thus avoiding the telltale scalpel incisions under the lashes. With the neocolagenises and neoelastogenises caused by the CO_2 laser in the dermis, we have a remarkable improvement in the tear trough deformity. Hester type I classification is: aging confined to lower lid, pseudoherniation of orbital fat, minimal skin and minimal muscle excess [6].

Koch demonstrated that the laser produced real skin contraction with his study on post-laser skin elasticity, showing an improvement of 22% in eyelid elasticity [9].

Approaches to lower palpebral fat pads can be performed via transconjunctival, either by resection or replacement, to camouflage the nasojugal sulcus, aka tear trough. This study presents data of Hester type I cases in which CO_2 laser was used for the treatment of the aging mid-third face. Furthermore, we use the CO_2 laser to treat the skin of Hester type I–IV, choosing a transconjunctival approach when necessary. In more advanced stages (Hester III and IV), we used an endoscopic mid-facelift procedure, always paying attention to the canthal support to prevent lower eyelid postoperative complication [26].

Roberts pointed out that the use of the traditional subciliary incision with myocutaneous flap became practically obsolete in his clinical/surgical practice due to the use of the laser, using the subciliary incision only in CO_2 patients presenting orbicular hypertrophy or the need for repositioning the fat pads [27].

In Hester type I cases, where aging is confined to the lower eyelid skin, the CO_2 laser offers an excellent approach and can be performed either as a standalone procedure or in association with others, under topical or local anesthesia with sedation, depending on need.

Initially approved for treating facial rhytids, hyaluronic acid fillers are now extensively used in periocular volume augmentation, although their use in the periocular space is considered off label. Nonetheless, their use can be associated with undesirable consequences, including filler visibility or palpability and/or edema that may prompt patients to seek additional procedures to improve their appearance [28, 29].

Even if the loss in thickness of soft tissues is certainly present in tear trough deformity, smoothing the tear trough hollow by filling the deformity could recontour an unnatural and puffy profile. This could give the mid-face a swollen appearance that might worsen over time in case of osmotic activity of the filler itself. On the other hand, fat injection could produce unpredictable results and require multiple surgical steps [20–32].

The CO_2 laser still offers the distinct advantage of improving the texture of the skin and addressing adjacent periorbital wrinkles. This makes the CO_2 laser a treatment rather than simply local (the eyelid), a regional (the face) treatment.

It is important to remember that our patients are treated globally, with other procedures associated with the CO_2 laser to better results. It is plausible that some of the good outcomes could be attributable to the concurrent procedures, particularly the facial fillers and/or facelifts. Nevertheless, it is important to recognize the contraction caused by the CO_2 laser as the main factor of the improvement.

As for complications, over time and with greater understanding, these have been increasingly addressed at the level of prevention with skincare, resulting in a very low complications rate today. Yet, it is important to reinforce that the CO_2 laser is a medical procedure with a chance of relevant complications, such as scarring or ectropium.

Currently, in our practice, complications are related to sporadic cases of cutaneous allergic reactions, with a fast and satisfactory resolution. The postoperative skin care protocol (Table 1) made a real difference in this evolution, predominantly in dyschromia.

Conclusion

In all cases, we achieved a reversal of Hester's type I aging, with documented improvement in the treated area.

In our personal experience, it is mandatory to continue a prescribed skin care regimen for at least 5 months post-operatively, thus preventing cutaneous hyperpigmentation and maintaining the stimulation of neocollagenesis.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest to disclose.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

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

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