

## Evaluation and Clinical Implication of Continuous Wave Fractionated CO<sub>2</sub> Laser for Non-Invasively Treat Lower Lid Laxity: A Retrospective Review

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Received: April 11, 2017; Published: May 05, 2017

### Abstract

**Introduction:** Infraorbital laxity and fat pad protrusion is a common problem of aging. Many subjects wish to cosmetically tighten the infraorbital skin area but are reluctant to undergo invasive procedures. Fractional CO<sub>2</sub> laser is the most effective method currently available for skin tightening. This study was a retrospective non-comparative study of a novel noninvasive method to safely tighten lower lids to enhance cosmesis and to reduce the appearance of aging in a variety of subjects of varying ages and Fitzpatrick types.

**Methods:** The results of fifty adult subjects was reviewed. All patients received fractional CO<sub>2</sub> treatments with energy levels that varied according to severity. Patients received treatment up to the lash line. Standardized color digital photography was taken at each visit. The primary outcome measure was an objective improvement in a paired comparison of pre-treatment and post-treatment (3 months) photographs. Treatment efficacy was evaluated by both the expert observer and the subject at each visit.

**Results:** Fifty patients receiving lower lid tightening with continuous wave fractional CO<sub>2</sub> laser. Both men and women were included in the study and the mean patient age was 50 years (ranges 19 - 76). Fitzpatrick types I-IV were treated. The majority of patients were Caucasian but Asian, Hispanic, Pacific Islander and African American were treated. All patients received one treatments with fractional CO<sub>2</sub> laser and two patients received two additional touch up treatments for incomplete results at the one month mark. At 3 months 89% showed 25% or more tightening. Eight subjects (8%) has 51 - 75% tightening at 3 months.

**Conclusions:** The use of fractional CO<sub>2</sub> laser was shown to be safe and effective in shrinking lower lids of patients of all ages and all tested Fitzpatrick types. More dramatic results may be seen with this technology with lighter Fitzpatrick types and in Asian subjects. Further study is warranted to determine the ideal power setting and number of treatments required to achieve desired results. Fractional CO<sub>2</sub> laser may be a safe alternative to mild to moderate lid laxity and fat pad protrusion.

**Keywords:** MIXTO; CO<sub>2</sub> Laser; Fractional CO<sub>2</sub>; Laser Resurfacing; Blepharoplasty

### Introduction

Aging of Skin is a natural, multifactorial process that results in skin thinning, skin laxity, wrinkles, and gravitational changes. These changes are especially visible in the very thin tissues of the lower eyelid and are influenced by various factors related to genetics, skin pigmentation, and skin thickness as well as external factors like sun exposure, smoking, environmental, and nutritional status. Blepharoplasty is consistently one of most commonly performed procedures in aesthetic facial surgery [1]. More than 165,000 procedures were performed in America in 2014 according to the American Society for Aesthetic Plastic Surgery [2]. Topical therapies to enhance collagen production and reverse aging such as tretinoin (Retin-A), Vitamin C, and alpha and beta hydroxyacids can be effective but have limitations [3,4]. Surgical revision of dermatochalasis is the gold standard for treatment, but can expose patients to pain, bruising, and prolonged recovery times [5]. Fractional continuous wave CO<sub>2</sub> laser generates significant amount of residual heat in skin and induces immediate tissue tightening through selective skin vaporization, collateral thermal effects and long-term collagen stimulation by stimulation of fibroblasts

**Citation:** Melissa Morrison Toyos and Rolando Toyos. "Evaluation and Clinical Implication of Continuous Wave Fractionated CO<sub>2</sub> Laser for Non-Invasively Treat Lower Lid Laxity: A Retrospective Review". *EC Ophthalmology* 6.5 (2017): 125-129.

from the enhanced dermal heat [6,7]. Laser rejuvenation of lower lid skin using continuous wave CO<sub>2</sub> laser is low cost, noninvasive, has shorter operative and recovery times with more natural outcomes, and no scarring compared with traditional surgical techniques [8,9]. The aim of this retrospective study was to review 50 cases to evaluate the effectiveness of noninvasive fractional CO<sub>2</sub> laser for lower lid tightening as an alternative method of periorbital rejuvenation.

In this retrospective study, we reviewed charts and photographs of patients undergoing lower lid only and full face including lower lids continuous wave laser facial resurfacing, and performed at baseline and 3-month evaluations. Treatment efficacy was evaluated by both the expert observer and the subject at each visit. All patients signed an informed consent. The study included 41 women and 9 men. There were 38 Caucasian patients, 2 Hispanic, 2 Pacific Islander, 5 Mediterranean and 3 Asian patients. Mean age was 50 years of age (range 19 - 76). Patients were recruited from May of 2013 to November of 2016 and the study was completed in December of 2016. The inclusion criteria were skin phototypes I-IV and presence of lower lid dermatochalasis.

Exclusion criteria included active infection, compromised immune function, history of keloids, botulinum or filler injection within 3 months, prior lower lid laser, prior surgical procedures in the lower lid, photosensitivity, pregnancy, lactation, oral retinoid, eyelid malposition (entropion, ectropion, blepharoptosis, and retraction), abnormal eyelid movements (blepharospasm and seventh nerve palsy), and patients not considered to be able to follow treatment protocol.

All subjects completed a baseline clinical examination, including slit lamp, fundus, and lid examination, including measurement of palpebral fissure distance. Photographs were taken in frontal and lateral projections using Panasonic GH3 Lumix digital camera. Photographs were standardized in magnification, lighting, and positioning. Photographs were excluded if patients had partially closed lids.

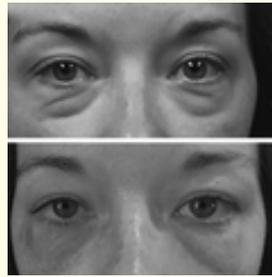
All subjects included in the study returned for 6-month evaluation, which included slit lamp examination and lid measurements of marginal reflex distance, upper lid crease distance, upper lid excursion, and palpebral fissure distance. Photographs were repeated in the frontal and lateral projections using the same camera, standardized in magnification, lighting, and positioning. Photographs were again excluded if patients had partially closed lids.

### **Laser Technique**

Local cutaneous anesthesia (lidocaine 23% and tetracaine 7%) was applied in a thin film two times 45 min apart before the procedure. Patients also had the option of receiving oral oxycodone with ibuprofen was given as well as oral promethazine and alprazolam. Honeywell IPL-Aid topical lid stickers were applied for ocular protection. The patient was placed in the supine position with the operator behind the patient's head. The infraorbital regions were treated from the lower lid lashline to the zygoma with the 300 and 180 μm handpieces in two passes each, titrating the laser power to observable skin retraction. Subsequent passes were made at a 45° angle to each other. Laser settings were 20% density, indexes of six or eight depending on skin type, and power of 10 - 15 W depending on skin type and skin reaction. All procedures were completed using the MIXTO fractional CO<sub>2</sub> laser (MIXTO Pro Slim Evolution II). Immediate postoperative care included a normal saline rinse of the skin, a topical vitamin C cream, and Vaniply, a fragrance-free noncomedogenic ointment (PSICO, Rochester, MN). Two patients required topical steroid for residually inflamed areas and were prescribed topical neomycin polymycin dexamethasone at 2-4 times daily for up to 2 weeks.

A total of 50 patients with mild to moderate lower eyelid dermatochalasis were treated using fractional continuous wave CO<sub>2</sub> laser. Patients were seen for evaluation of final clinical outcomes at 3 months after a single laser treatment. Patients reported minimal discomfort during the procedure and minor discomfort afterward, controlled with only oral nonsteroidals. Side effects were mild, with subjects reporting crusting, oozing, and edema that resolved within 17 days.

We evaluated the change in lower lid laxity from baseline. Three months after one MIXTO CO<sub>2</sub> continuous wave laser treatment, the appearance of the lower lids was noticeable in almost every case, palpebral fissure distance increased from an average of 5.6 to 6.8 mm (p = 0.05) (Figure 1-3).



*Figure 1: Baseline and immediate posttreatment photo of lower lids (Patient consent obtained).*



*Figure 2: Baseline and 1-month postoperative appearance of lower lids (Patient consent obtained).*



*Figure 3: Baseline and 3-month postoperative appearance of lower lids (Patient consent obtained).*

## Results

A total of 50 patients with mild to moderate lower eyelid dermatochalasis were treated using fractional continuous wave CO<sub>2</sub> laser. Men (7 patients) and women (43 patients) were included in the study. The majority of patients were Caucasian women Fitzpatrick Skin Types 1 and II (62%). Also included were Asian (10%), Hispanic (8%), Pacific Islander (4%) and African American (6%). All patients received one therapeutic laser lesion and 2 patients requested and received additional laser under eye for additional lid tightening at one month post-operatively. Patients were seen for evaluation of final clinical outcomes at 3 months after a single laser treatment. Patients reported minimal discomfort during the procedure and minor discomfort afterward, controlled with oral nonsteroidals. Side effects were mild, with subjects reporting crusting, oozing, and edema that resolved within 10 days. We measured the results in terms of the change in skin texture and wrinkling in person and in photographs. Treatment efficacy was also evaluated by the subject at each visit.

## Discussion

Lower lid dermatochalasis is a common side effect of aging and cosmetic challenge. Many patients seek surgical and non-surgical methods of rejuvenation each year [10]. As the focal point of the face, rejuvenation of the periorbital area presents unique challenges related to the function and safety of the eye [11]. Noninvasive but effective laser procedures that reduce pain, swelling, downtime, and scarring would offer a unique benefit to patients seeking lid rejuvenation.

Traditional surgical blepharoplasty remains the gold standard in periorbital rejuvenation but is commonly associated with pain, bruising, edema, and the potential for serious complications. The postoperative healing period averages 6 weeks [12]. Scarring is a feature of all incisional surgical procedures and can also be cosmetically undesirable.

There are many limitations to this study. It is retrospective with no control arm. There is regional bias in that all patients were from a common geographic territory, predominantly female and Caucasian. All patients were treated by one surgeon in one center. In addition, the number of patients treated is small and the study is not powered to show strong statistical differences.

In general, CO<sub>2</sub> lasers even ones utilizing fractional technology can cause serious side effects such as hyper- or hypopigmentation, viral exanthems, scarring, and infection. When used near the eye, reported side effects include corneal or scleral burns, loss of vision, and ectropion. Newer techniques leave a healthy rim of tissue surrounding the treated area and utilize a non-sequential microspot pattern to minimize collateral thermal effects. These advances minimize, but do not eliminate, pain and side effects associated with CO<sub>2</sub> laser.

Newer version of CO<sub>2</sub> lasers maximize targeted thermal effect but minimize the collateral thermal damage by allowing some heat to dissipate before the next laser spot is applied in the same area which can reduce pain, side effects, and downtime. Continuous wave lasers are unique in that they use lower laser energies to build heat in target tissues over longer periods of time. Continuous wave lasers are currently popular in other areas of ophthalmology, primarily glaucoma and retina. The micropulse laser trabeculoplasty (Iridex, Mountain View, CA) lowers intraocular pressure similarly to the selective laser trabeculoplasty (SLT; Lumenis, San Jose, CA) but with less inflammation and no structural damage to the trabecular meshwork by ultrasound microscopy compared with SLT [13]. The continuous wave retinal diode laser (Iridex) is the first of its type to be able to eliminate macular edema and drusen without scarring or damaging the most delicate retinal tissue found in the macula [14].

The MIXTO laser uses a 10,600 nm wavelength and a continuous wave micropulsed laser to separate microbeam impulses by time and space to reduce thermal injury, allowing the treated area to cool between pulses. The microspot reduces the time to reepithelialization from weeks to 1 - 2 days, reducing infection risk because of delayed re-epithelialization [15].

## **Conclusions**

Surgical or invasive blepharoplasty has long been the gold standard for rejuvenation of lower eyelid dermatochalasis, although patients routinely experience bleeding, bruising, edema, scarring, and downtime as well as the risks of serious complications such as bleeding, infection and scarring that can result in an unnatural postoperative appearance. Continuous wave microspot lasers are known to generate greater amounts of nonscarring heat within skin than other CO<sub>2</sub> lasers currently on the market to stimulate skin to naturally tighten both immediately and long term and improve texture and resistance to gravitational effects that can be useful in mild to moderate periorbital skin laxity due to aging. Procedures can be performed in the office and outside of traditional operating rooms, reducing costs to both patients and practitioners. This laser provides decreased recovery period, higher safety profile, and the potential for more natural cosmetic outcome compared with traditional blepharoplasty.

This study evaluated improvements in common lid measurements for dermatochalasis and skin laxity by using a fractionated continuous wave CO<sub>2</sub> laser in patients with dermatochalasis over a 3-month period after laser resurfacing of the lower lid area.

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**Volume 6 Issue 5 May 2017**

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