



Eyebrows Lifting Using Fractional CO₂ Laser.

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Abstract

Introduction: Several therapeutic modalities, such as surgeries, cutaneous lifting, botullinum toxin and ablative techniques are used for eyebrow lifting, but they have many limitations. Thus, a search for other less invasive methods is a necessary.

Objective: The present study was aimed at evaluating the efficacy and safety of an ablative fractional carbon dioxide (CO₂) laser in the dropped eyebrows.

Methods: A prospective study was carried out with 20 patients who underwent a 2-3 sessions of fractional CO₂ laser, with moderate energy and density, for the treatment of sagged brows. Photographs taken before and 30 days after the procedure were evaluated by two examiners unrelated to the study, who looked at the effect of the laser on the sagged brows.

Results: Three months after the treatment, it was possible to observe clinical improvement in 45% of the patients, in all the variables evaluated. Observed side effects were: transient erythema and edema in the early post-procedure period.

Conclusion: Fractional CO₂ laser has proven to be a safe and effective option for the treatment of dropped eyebrows.

Keywords: sagged brows; laser therapy; carbon dioxide.

Introduction

Skin aging is a continuous process and has two distinct types intrinsic (internal) which is genetically determined and extrinsic (external) induced by various environmental factors like sun light, repetitive facial expression, gravity, and smoking. The cumulative effect of these two factors causes various morphological and structural changes in skin components which are more prominent on facial skin such as wrinkles, thinning of skin, atrophy of subcutaneous fat, prominent nasolabial fold, jowl, etc. The typical aging changes in orbital region are brow

ptosis, dermatochalasis, blepharochalasis, periorbital wrinkles, fat pad, etc. (Gonzalez-Ulloa M, 1965). Numerous procedures for correcting periorbital aging are described in the literature. Medical therapy such as tretinoin cream and chemical peels (glycolic acid) can be satisfying for patients with mild aging and for those not willing aggressive interventions. Blepharoplasty and brow lift (or endoscopical techniques) are surgical procedures that are considered to be the gold standard for the treatment of periorbital aging but require painful and a more prolonged recovery and possible complications. (Warner JPM, Gutowski KAM. 2006)

How old one appears (mainly in the face) is much a result of how much sun damage he or she has suffered than it is of his or her chronological age. The sun gives UV radiation, which is responsible for the skin damage. The most obvious manifestation of a less pliable dermis is facial wrinkles that develop where the skin is folded by the contraction of expressive muscles. For example, raising the eyebrows causes horizontal forehead wrinkles, frowning causes frown lines. Overall skin laxity or looseness is another feature of sun-damaged facial skin. The primary force that appears to contribute to skin laxity is gravity. Over a lifetime, approximately two-thirds of which is spent in an upright position, gravity actually stretches facial skin, causing most anatomic features to droop. Gravity also gradually stretches the underlying fascia, the superficial connective tissue deep to the skin. The eyebrows sink, the nasolabial furrow deepens and the jowls (the lower cheek) drop below the jaw line. Facial skin becomes redundant; the excess skin accentuates the depth and severity of wrinkles (Robert Langdon. M.D:2004). **LASER** gained widespread acceptance in dermatology and is now used for the treatment of numerous cutaneous conditions including skin tightening, skin aging, pigmented lesions, scars, and unwanted hair (Maiman T.1960).

Laser tissue interactions: When a laser is used on the skin, it can be absorbed, reflected, transmitted or scattered. The possible effects like photothermal and photochemical occur once laser energy is absorbed.¹³(Markolf H. Niemz;2007). **CO₂ laser ablation:** Ablative resurfacing has historically been performed using the CO₂ laser. It's used for rhytids,

acne scars, and other signs of photoaging.¹⁷(Baumann L 2009). At a wavelength of 10,600 nm, in far infrared spectrum, energy is preferentially absorbed by intracellular and extracellular water creating rapid heating and vaporization of tissue.

It appears that thermal injury below the vaporization zone induces desiccation and collagen shrinkage, which serves as a scaffold for the formation and deposition of new collagen. Immunohistochemistry evaluations demonstrated up-regulation of procollagens I and II, interleukin 1- , TNF- , TGF- 1 and matrix.¹⁸(Štulhofer Buzina D, et al; 2010)

Ablative fractional lasers have been able to reduce the trauma of the treatment and decrease downtime while retaining resurfacing power. They are significantly safer than their nonfractionated counterparts. The main use of these lasers is for mild skin tightening to battle laxity and rhytids.²⁶(Chwalek J, Goldberg DJ 2011)

Patients and Methods

This was a prospective study done at private clinic during the period from May 2017 to December 2017.

Twenty patients with facial wrinkles, skin laxity and photoaged skin (13 females, 7 males) were involved in the study. Their ages ranged from 46 to 68 years (mean age 52 years). Eleven patients with Fitzpatrick's skin type III and nine had type IV, as in table (1).

Table:(1) Fitzpatrick's skin types. (Klaus W. Richard A. J.2006)

| Skin type | Skin color | Sunburn & tanning history |
|-----------|------------|----------------------------------|
| I | White | Always burn, never tans |
| II | White | Always burn, tans minimally |
| III | White | Burns moderately, tans gradually |
| IV | Olive | Minimal burning, tans well |
| V | Brown | Sometime burns & tans darkly |
| VI | Dark brown | Never burns & tans darkly-black. |

Inclusion and exclusion criteria: Any patient of any age in good health, with fair skin type, who has mild-moderate eyebrows dropping, photodamaged skin and realistic expectations. It was a must to have full history to know the ability of wound healing, as well as possible conditions that could have an impact on it:

diet, anemia, immunodeficiency, connective tissue disorders, and isotretinoin therapy. Absolute contraindications to the procedure include: A history of keloids, radiation therapy or scleroderma, pregnancy, unrealistic expectations, and koebnerizing skin diseases like vitiligo and psoriasis.

In all patients topical antibiotics, oral antiherpes and sunscreen cream were prescribed. Patients were advised to avoid sun exposure, smoking, scratching the treated area. They were encouraged to use topical emollients.

Clinical examination:

All patients were assessed at pre- and post-treatment. They were checked for local infections and any other skin disease and skin type and the level of eyebrows. Improvements in skin laxity and eyebrow level were

evaluated photographically, and by recording patients satisfaction scale. Photographs were taken using a digital camera (Nikkon, DX 5100,5.6 megapixel power, Thailand) before, immediately after each session and one month later for comparison. Also looking for any adverse effects clinically and by history of any symptoms. The improvement graded by measuring the vertical line from midpupil of the eye to the eyebrow. Pain graded during treatment on a scale of: 0 (no pain) to 4 (very painful edema persisted for up to three to four days).Patients satisfaction was recorded as a scale of 4 points as bellow, table(2).

Table (2): Grading of patient satisfaction: (Dvora A. Bruce E. 2010)

| Grade | Satisfaction |
|-------|---------------------|
| 0 | Poor |
| 1 | Fair |
| 2 | Good |
| 3 | Complete(excellent) |

Protective opaque eye glasses were worn by the patients during irradiation to prevent the risk of eye injury.

Physicians also used special eye glasses with special wavelength filter and optical density for CO₂ laser. Good ventilation was assured in the room and a vaccume used to remove any smoke and vapor which might carry viral particles.

Methods: A written informed consent was given to patients and a questionnaire was used. Certain information obtained like: Name, age, sex, occupation, systemic review, dermatological diseases, drug history (retinoids), photosensitive diseases, facial or labial herpes, eye diseases, cosmetic procedures as threading, face liftings and botox therapy. Patients (females) were asked to remove any make up or any other topical remedies before treatment and to dry the area properly, contact lenses if any, were removed. Then the area was gently cleansed.

Topical aneesthesia EMLA 5% cream (eutactic mixture of local anaesthesia of lidocain and prilocaine) applied to the area for 40 minutes under occlusion before treatment. After applying these preparations and selecting the suitable parameters, patients were treated two to three times in the supraorbital and temporal areas at 4 weeks interval with a fractional CO₂ laser device equipped with a computed scanning handpiece. The laser handpiece was applied

perpendicularly to the area and moved the handpiece from zone to another (without overlap).

Laser parameters: Fractional CO₂ device produces multiple tiny wounds (MTZ) to the epidermis and dermis. Settings were the following: power 12-16 watts (W). After the initial treatment with a low power setting, power was increased at subsequent sessions as tolerated by the subjects. For example, the first treatment settings might be 12 watts. The second session would have energies increased to 14-16 watts.

The laser action time duration was (1ms) in each point during the scanning process. The time interval between point and next point was (1ms), distance between fractional points was (1.3 mm).

Eyebrow elevation was assessed by the investigators from standardized photographs obtained before treatment and at each follow-up visit. To measure elevation, a horizontal line was drawn from the medial to the lateral canthus, and then a vertical line perpendicular to the horizontal line was drawn from the eyebrow to the midpoint of the pupil. The perpendicular distance (mm) from the center of the pupil to the eyebrow midpoint was considered the eyebrow elevation. Elevation was scored before and after 30 days of treatment using the following scale: 1=0–1 mm; 2=1–2 mm; 3=2–3 mm; 4=3 or more mm.

Results

Patient satisfaction was high and the procedure was well tolerated. Clinical examples are shown in table (3):

Table (3) percent of patients scoring improvement.

| Score | 1 st month % | 2 nd month % | 3 rd month % |
|-------|-------------------------|-------------------------|-------------------------|
| 1 | 60 | 50 | 35 |
| 2 | 30 | 30 | 25 |
| 3 | 10 | 10 | 30 |
| 4 | 0 | 10 | 10 |

Scale: 1=0-1mm, 2=1-2mm, 3=2-3, 4>3mm.

About 70% were highly satisfied and 10% reported for each of the other grades.

Table(4): Percent of patients and satisfaction grade.

| | Excellent | Good | Fair | Poor |
|---------------------------------------|-----------|------|------|------|
| Grade of satisfaction / % of patients | 70 | 10 | 10 | 10 |

Minimal redness and swelling last 24-72 hours after treatment, these resolved by antihistamines. Downtime was mostly one day. Undesirable effects were reported mainly erythema in 18 (90%) patients, and swelling in 8 (40%) patients. These started shortly after sessions (within few minutes), erosions and crusting were noticed in 6(30%) patients, which was controlled by topical and systemic antibiotics. Ten patients (50%)

complained from mild itching that persists for 5-7 days. Fortunately, no infection was reported in this study. Again, no case of dyspigmentation reported and no scarring occurred. The procedure was comfortable apart from mild discomfort experienced by half of patients, mild pain in 15%, one patient claimed moderate pain.

Table (5) pain score and patients percentage.

| Pain score | 0 | 1 | 2 | 3 | 4 |
|----------------|----|----|----|---|---|
| % of patients. | 30 | 50 | 15 | 5 | 0 |



Fig.(1):A;50 years old female patient (A before, and B; after 2 months) about 2 mm elevation of eyebrows.

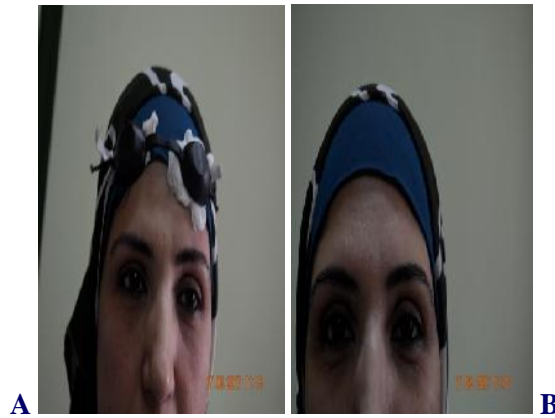


Fig.(2):A ;A 46 years old female patient (A: before and B:after two sessions)1mm elevation of eyebrows.



Fig.(3): A 45 years old female (A before) and (B, after) 2 months after the 2nd session.3mm elevation of eyebrows.

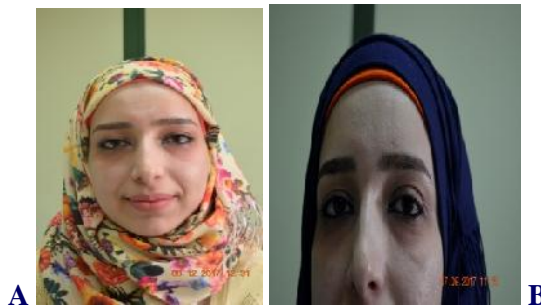


Fig.(4) A 39 old female:(A, before) and(B, after 3months).



Fig.(5): A42 years old male. A:before. B: redness three days after laser, more sever reaction due to higher power used (16 watt).

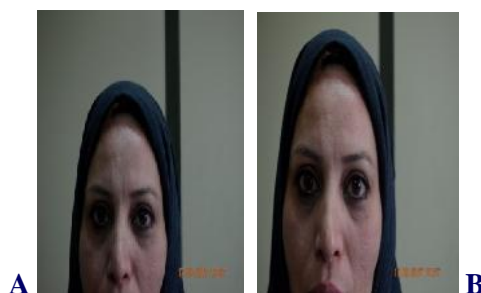


Fig.(6): A 47 years old female(A, before) and (B, after): showed moderate improvement after 3 months.

Discussion

Dropped eyebrows may develop from aging and sun-induced changes in dermal collagen or by tension in underlying muscles.(Dvora A. Bruce E. 2010. Keen M. et al.1994).This study showed that fractional CO₂ laser devices provide measurable improvement in skin laxity and eyebrow lifting. Patient satisfaction was good and the procedure was well tolerated. The advantage of multiple treatments with relatively low powers is that downtime and adverse effects, especially pain during and after treatment, were minimized.

In this study the area of forehead above eyebrows and temporal zone were treated in order to achieve an isomorphic skin, since these areas are regarded as one cosmetic unit. Fortunately, this caused skin tightening in two vectors; vertical and temporal that intensifies the tension on the upper lid and possibly helped increasing skin tension. The upper eyelid moderately elevated by tightening the forehead above eyebrow. This was clinically evident in nine (45%) of patients. These findings were somewhat, similar to that found by Ruiz-Esparza and colleagues,(Ruiz-Esparza J.2004) using a nonablative RF device, who achieved improvement in upper eyelid laxity by treating extraorbital areas of nine patients(although by different device).

The present study was the first in Iraq to prospectively evaluate the use of a fractional CO₂ laser device for the treatment of dropped eyebrows. It is difficult to compare the results with those of other trials because of different numbers of treatment sessions and methods used to assess results.

These results are comparable to those found by Dvora ancona and Bruce e. Katz who used comparable parameters and achieved (sixty percent of patients showed 26–50% improvement in eyelid wrinkles and skin laxity at three months). (Dvora A. Bruce E.2010).

In fractional CO₂ resurfacing, these changes are thought to be due to shrinkage of dermal collagen and induction of neocollagenesis. The response was more evident after the second session. It is preferable to do more sessions to maintain the results.

The careful laser technique (starting with low effective parameters and gradually rising energies) and optimal patient selection yielded minimal side effects in comparison with the outcomes. Mainly redness and swelling happened and subsided within few days with simple measures. Infections not reported though topical antibiotics were used prophylactically. Also no scarring or ectropion or any other eye injury occurred.

Using EMLA 5% under occlusion for enough time and selecting low wattage initially made the sessions tolerable and relatively pain free, this allows easy and proper treatment of the delicate anatomical areas.

The observation of perceptible eyebrow elevation in 45% of our patients agree with a study by Sukal and colleagues who reported eyelid tightening with a nonablative 1550 nm erbium-doped fractional laser. Twenty-six percent showed an elevation in brow position.

Of great importance is the brow lifting, which is regarded as a means of brow and upper-eyelid rejuvenation. However, Sukal and colleagues⁷¹ noted similar eyebrow lifting effect in 26% of subjects who had full-face treatments. (Sukal SA. et al. 2008) Treatment of the lateral periorbital areas (and skin of the superior and lateral orbital rim) in our study may have caused skin-tightening vectors that were responsible for the elevation in the eyebrows.

The short downtime spent by subjects in this study contrasts with other trials using fractional CO₂ lasers where the downtime was often three to five days. The reason for this difference is likely because of the low wattages used in the initial sessions and the very careful increases in energies used in subsequent sessions. Most patients had significant downtime for only one day with only mild erythema and edema for several days after the treatments.

Again, this study agrees with Biesman and colleagues, who stated that making appropriate expectations is the key to patient satisfaction. (Biesman BS, et al. 2006) The procedure in the present study, although not an alternative to blepharoplasty surgery, is a viable non-surgical option for rejuvenating the periorbital facial skin and eyebrow lifting.

Conclusions

Treatment with a fractional CO₂ laser device produces long-lasting improvement in skin laxity and eyebrow lifting after an average of two treatments spaced three to four weeks.

Adverse events were minimal and the procedure was safe, effective and well tolerable.

Proper patient selection and establishing logical expectations are mandatory for treatment success and satisfaction.

Recommendations

1. Continue to follow subjects for longer periods to further evaluate the longevity of clinical benefits.
2. Further comparative studies with different fractional CO₂ parameters and other laser systems to get the best choices.

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|  | Website: www.ijarbs.com |
| | Subject: Medical Sciences |
| Quick Response Code | |
| DOI: 10.22192/ijarbs.2018.05.04.022 | |

How to cite this article:

Mazin Hamid Ayyash. (2018). Eyebrows Lifting Using Fractional CO₂ Laser. Int. J. Adv. Res. Biol. Sci. 5(4): 218-225.

DOI: <http://dx.doi.org/10.22192/ijarbs.2018.05.04.022>