

# Clinical investigation of post blepharoplasty adjuvant carbon dioxide laser resurfacing

Ali Arkan Alsagban, Muhanad Lebnan Alshami\*, Mohammed Abbood Al-Maliky#

Department of Dentistry, Dijlah University College, Baghdad, Iraq.

\* Department of Biomedical Applications, Institute of Laser for postgraduate studies, University of Baghdad, Baghdad, Iraq.

# Department of Dentistry, Al-Hadi University College, Baghdad, Iraq.

## Abstract

**Background** Aging is continuous process that affects negatively people social activities. Aesthetic procedures can bring confidence, happiness and improves social relationships. The goal of this study is the evaluation the eyelid skin tightening after the post blepharoplasty adjuvant CO<sub>2</sub> laser carried out at one month after the surgery.

**Methods** Eleven patients with age range of 34 to 57 years were treated by blepharoplasty surgery followed by laser resurfacing after one month of the surgery. The first session of laser irradiation were carried out under topical anesthesia at one month from the day of surgery. The degree of wrinkles of both upper and lower eyelids was measured by Image J V 1.51K computer software for the recorded photographs both before and at one month after treatment.

**Results** Descriptive results of the treatment before and after CO<sub>2</sub> laser irradiation were 125.53 ( $\pm 2.17$ ) and 115.13 ( $\pm 14.55$ ) pixels, respectively. The Wilcoxon Signed Ranks statistical test showed a significant difference between the before and after treatment wrinkles reduction,  $p=0.016$ .

**Conclusion** Adding the CO<sub>2</sub> laser as assisted tool for this procedure has led to synergistic effect for eyelid skin tightening by 8.3%.

## Key words

Blepharoplasty, fractional CO<sub>2</sub> laser, aging, eyelid, eye wrinkles.

## Introduction

Aging is continuous process which affects negatively people social activities. Aesthetic procedures can bring confidence, happiness and improvement of social relationships. Aging could result from genetic or environmental factors or both. The environmental factors are sun exposure, smoking and gravity leading to structural and morphological changes in skin

like wrinkles, subcutaneous fat atrophy and thinning of skin. lid skin aging signs that could be seen as wrinkles are: blepharochalasis (excessive thin skin), fat pad and brow ptosis.<sup>1</sup> Mild signs of aging may be treated by medicaments like chemical peels and tretinoin.<sup>2</sup>

One of the common procedures in aesthetic surgery is blepharoplasty that could be done either under local anesthesia or moderate sedation.<sup>3</sup> It is called eyelid surgery which includes surgical removal of excess orbital skin or fat tissues. The traditional approach for blepharoplasty is the subciliary incision in which both skin and muscle are raised for the correction of the herniated fat.<sup>4</sup> Skin pinch

---

## Address for correspondence

Mohammed Abbood Al-Maliky  
Department of Biomedical Applications,  
Institute of Laser for Postgraduate Studies,  
University of Baghdad, Baghdad, Iraq.  
Ph: +9647723676000  
Email: m.a.almaliky@ilps.uobaghdad.edu.iq

blepharoplasty is easy to perform where only excess skin is removed avoiding orbicularis muscle and nerve injury.<sup>5,6</sup>

Carbon dioxide laser (CO<sub>2</sub>) laser has supportive advantage to the surgical site through skin tightening and collagen shrinkage.<sup>7</sup> This laser with a wavelength of 10.6 μm has high absorption in water which is the main constituent of the soft tissues, thus offering a good incision and excision tool for surgeons. Furthermore, when used in a defocus mode it has coagulation potential which reduces ecchymosis that leads to a better patient satisfaction.<sup>8</sup> The ability of this system to operate in ultrashort pulse emission has led to a controlled skin ablation during skin resurfacing.

The goal of this study was the evaluation of the eyelid skin tightening after the post blepharoplasty adjuvant CO<sub>2</sub> laser carried out at 1 month after the surgery.

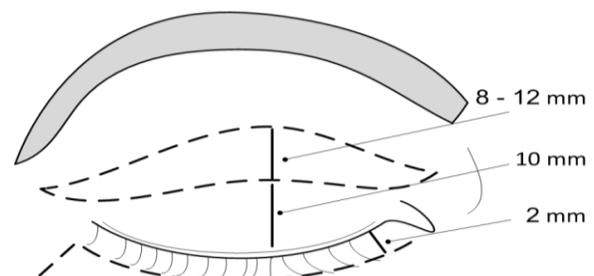
## Materials and Method

**Operative Protocol** During the period from July 2015 to December 2018, 11 patients were treated by blepharoplasty adjuvant CO<sub>2</sub> laser resurfacing for upper and lower eyelids by the first author of this paper. Patients with age range of 34 to 57 years were treated by blepharoplasty surgery followed by laser resurfacing after 1 month of the surgery. The exclusion criteria were medically compromised patients, patients with allergy to the local anesthesia and patients who have skin resurfacing before this current treatment. The results of the treatment were compared to the pre-treatment conditions as a control. Informed consent was obtained from all participants in this study prior to the treatment.

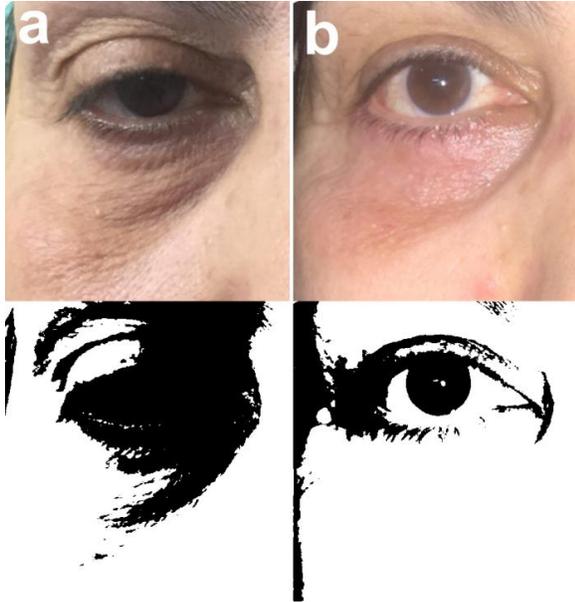
After patient admission, the blepharoplasty procedure started by marking the upper and lower eyelids while the patient is standing in

upright position as shown in **Figure 1**. The surgical procedure was done under local anesthesia by injection of 2% lidocaine, epinephrine 1:200000. It was injected as a nerve block to the infra orbital, zygomatico-facial, zygomatico-temporal, supra orbital, supratrochlear and infratrochlear nerves as well as an infiltration anesthesia to upper and lower lids to ensure hemostasis and postoperative analgesia. 12 mm incision of the upper eyelid was done after applying the pinch test. The incised area was excised afterward. For the lower eyelid, the incision began at the lateral extension of the lid 2 mm from the lower eyelash within the crows' feet. Then undermining of all the lower lid area was done by making a pocket from the subciliary area to the inferior orbital rim area. The pocket was undermined by sharp dissecting scissor including all the subciliary line. Followed by pulling the flap passively upward and laterally with patient looking upward and mouth opened widely to stretch the lid to the maximum to avoid postoperative pulling and ectropion due to over resection of the skin.

If required, incising the orbital septum and excision of prolapsed fat was done. Also additionally, if needed a lateral anchorage of the lower lid to the periosteum of the lateral orbital rim above the lateral canthus was employed. Wound was sutured by 5/0 nylon suture using the subcuticular technique, and the suture was removed at seven days after the surgery.



**Figure 1** Design of upper and lower eyelids excision lines



**Figure 2** Blepharoplasty and CO2 laser therapy. 1 month pre- (a) and postoperative (b) laser treatment

Routine postoperative wound care was done at the follow up visits.

**Laser Irradiation** The laser irradiation was carried out under topical anesthesia (emla 5%. Astra Zeneca AB, Södertälje, Sweden) 1 month after the surgery. If needed it was followed by second session of laser at 6 weeks from the first laser session.

The used laser system was a fractional CO<sub>2</sub> (ADSS Corp., Beijing, China) at a peak power of 25 W, pulse duration 0.8 ms, pulse interval 1 s, the spacing between the fractioned beams was 1 mm, and the area of the irradiated area was 20 mm<sup>2</sup> as a square shape. The whole area of the upper and lower eyelids was irradiated once without pulse overlapping.

**Eye wrinkles mathematical calculation** The degree of wrinkles of both the upper and lower eyelids was measured by ImageJ V 1.51K computer software (National institute of Health, USA) for the recorded photographs for both before and 1 month after laser treatment. The photographs were converted to 8-bit type to be

in the black and white mode (**Figure 2**). The results were obtained in pixels using the function StdDev in the program and the degree of improvement was calculated in percent of reduction in these pixels after the treatment compared to those before the treatment.

**Qualitative assessment** Patients satisfaction scores to the treatment were evaluated by a scale adopted from Kontoes et al.<sup>8</sup> A laser-assisted blepharoplasty result is considered “Excellent” when the patient is absolutely satisfied, “Good” when the patient is satisfied with slight scar and hyperpigmentation, “Average” when the patient has concerns and makeup is required to cover the scar and finally it is considered “Poor” when the patient is dissatisfied and revision of the treatment is required.

### Statistical analysis

IBM SPSS 21.0 (IBM Corp., Armonk, NY, USA) was applied for the statistical testing. Descriptive parameters and Wilcoxon Signed Ranks test was employed to investigate the statistical differences between the treatment groups. The significance level was set to 0.05.

### Results

Descriptive results of the treatment results before and after CO<sub>2</sub> laser irradiation were 125.53 ( $\pm 2.17$ ) and 115.13 ( $\pm 14.55$ ) pixels, respectively. Statistical testing showed a non-normal distribution of the results. Accordingly, the Wilcoxon Signed Ranks test was used to investigate whether there is a significant difference between the before and after CO<sub>2</sub> laser irradiation results. The statistical test showed a significant difference after treatment,  $p = 0.016$  (**Table 1 & 2**). The overall reduction in the eyelid skin wrinkles was 8.3%. Regarding the questionnaire of the patients’ satisfaction, results showed that 54.54% of the patients

**Table 1** Descriptive results and statistics of eye lid skin wrinkles improvement before and after CO<sub>2</sub> laser irradiation.

Statistics	Before	After
Minimum	120.35	86.99
Maximum	127.51	127.31
Mean	125.53	115.13
Std. Deviation	2.17	14.55
Mean Rank	6.67	3.00
Wilcoxon Signed	Z Score	2.40
Ranks Test	p Value	0.016

**Table 2** Summary table of the demographics of the treated patients

Gender	
Male	0
Female	11
Age	
30 - 39	2
40 - 49	3
50 - 59	6
Race	Middle east
Previous CO <sub>2</sub> resurfacing	No

selected the Excellent score and 45.45% of them selected the Good score for the treatment results.

## Discussion

Blepharoplasty is a frequently demanded surgery by patients. This is due to fact that the eyes draw the viewers' attention and the signs of aging start around the eyes. The cause behind this fact is that the skin around the eyes is sensitive to sunlight and gravity. This medical problem can be solved using lasers in ablative or non-ablative mode for skin resurfacing or by several plastic surgery procedures.<sup>9,10</sup>

In the current study, skin resurfacing in the upper and lower eyelids 1 month after a blepharoplasty surgery showed an additional reduction in the skin wrinkles by 8.3% with a significant difference in the statistical testing.

Previously, CO<sub>2</sub> laser was widely used for more than 50 years in a pulsed or defocused laser beam in medicine with reported interesting results. In the current study, this laser was

applied in the fractional laser beam mode in which the laser beam is portioned into customized parts to avoid the possible side effects. These side effects are skin hyperpigmentation and erythema.<sup>11</sup> Although these side effects usually resolve spontaneously with time, they represent a psychological problem and interferes with the daily life and job environment of the patients.

Fractional CO<sub>2</sub> laser showed an improvement when used for postsurgical scar resurfacing, with a significant patients satisfaction score, effectiveness and safety.<sup>12</sup> These findings were in close agreement to the results of current study. The current study evaluated the treatment 1 month after CO<sub>2</sub> laser resurfacing; this treatment was indicated to be applicable for up to 6 months after eyelid skin resurfacing.<sup>13</sup>

The advantages of skin resurfacing are by treating skin wrinkles, irregularities, and mild skin excess. However, this procedure requires, in average, 1 week for re-epithelization and produces skin erythema which may lasts for weeks. A complete flattening of the rete ridges of the epidermis may lasts for 3 months.<sup>14</sup>

The patients treated in this study had skin type 3 according to the Fitzpatrick classification. Although these classes are considered to have a high risk of hyperpigmentation after lasing<sup>11</sup>, it was not reported in the current study due to the used laser parameters and the application of laser beam using the fractional hand piece. Additionally, fractional CO<sub>2</sub> laser resurfacing has the advantage of increasing type I collagen synthesis. This will help especially in older patients who have decreased collagen synthesis.<sup>15</sup> Additional point to be mentioned is that the laser irradiation was conducted after one month of the blepharoplasty surgery and not immediately to avoid wound dehiscence. On the other hand, this study results were based on low

sample number, and it is recommended to have a large number of patients for future studies to further supports the findings of the current study.

## Conclusions

Blepharoplasty is considered a standardized procedure for correction of the signs of skin aging around eyes. Adding the CO<sub>2</sub> laser as an assisted tool for this procedure has led to a synergistic effect for eyelid skin tightening by 8.3%. The treated patients indicated a degree of satisfaction ranging from good to excellent for the treatment results.

## References

1. Gonzalez-Ulloa M, Flores ES. Senility of the face-basic study to understand its causes and effects. *Plast Reconstr Surg* 1965; 36: 239-246.
2. Warner JP, Gutowski KA. Surgical improvement of the aging forehead and eyelids. *Clin Obstet Gynecol* 2006; 49:367-374.
3. Patel BC, Malhotra R (2020) Mid Forehead Brow Lift. In: *Stat Pearls*. Stat Pearls Publishing LLC., Treasure Island (FL),
4. Naik MN, Honavar SG, Das S, Desai S, Dhepe N. Blepharoplasty: an overview. *J Cutan Aesthet Surg* 2009; 2: 6-11. <https://doi.org/10.4103/0974-2077.53092>.
5. Massry GG. Commentary on: Achieving a Youthful Midface: Examination of Midface Anatomy Improvement Following Lower Blepharoplasty With Fat Transposition and Transtemporal Midface Lift With Lower Lid Skin Pinch. *Aesthet Surg J* 2019; 39: 429-430. <https://doi.org/10.1093/asj/sjz210>.
6. Choi B, Yang S, Park J, Lee H, Baek S. Effectiveness and Satisfaction Degree of Transconjunctival-Approach Lower Blepharoplasty Combined With Pinch Skin Excision Technique. *Journal of Craniofacial Surgery* 2020; 31(3): 766-8. <https://doi.org/10.1097/scs.00000000000006102>.
7. Fulton JE, Jr., Barnes T. Collagen shrinkage (selective dermaplasty) with the high-energy pulsed carbon dioxide laser. *Dermatol Surg* 1998; 24: 37-41. <https://doi.org/10.1111/j.1524-4725.1998.tb04049.x>
8. Kontoes PP, Lambrinaki N, Vlachos SP. Laser-assisted blepharoplasty and inferior lateral retinaculum plication: skin contraction versus skin traction. *Aesthetic Plast Surg* 2007; 31: 579-585. <https://doi.org/10.1007/s00266-007-0036-0>.
9. Sukal SA, Chapas AM, Bernstein LJ, Hale EK, Kim KH, Geronemus RG. Eyelid tightening and improved eyelid aperture through nonablative fractional resurfacing. *Dermatol Surg* 2008; 34: 1454-8. <https://doi.org/10.1111/j.1524-4725.2008.34308.x>
10. Roberts TL, 3rd, Yokoo KM. In pursuit of optimal periorbital rejuvenation: laser resurfacing with or without blepharoplasty and brow lift. *Aesthet Surg J* 1998; 18:321-332.
11. Manuskiatti W, Triwongwaranat D, Varothai S, Eimpunth S, Wanitphakdeedecha R. Efficacy and safety of a carbon-dioxide ablative fractional resurfacing device for treatment of atrophic acne scars in Asians. *J Am Acad Dermatol* 2010; 63:274-283. <https://doi.org/10.1016/j.jaad.2009.08.051>
12. Ibrahim SM, Saudi WM, Abozeid MF, Elsaie ML. Early fractional carbon dioxide laser intervention for postsurgical scars in skin of color. *Clin Cosmet Investig Dermatol* 2019 12: 29-34. <https://doi.org/10.2147/CCID.S177622>.
13. Toyos MM. Continuous Wave Fractional CO<sub>2</sub> Laser for the Treatment of Upper Eyelid Dermatochalasis and Periorbital Rejuvenation. *Photomed Laser Surg* 2017; 35:278-281. <https://doi.org/10.1089/pho.2016.4225>.
14. Mannor GE, Phelps RG, Friedman AH, Meltzer M. Eyelid healing after carbon dioxide laser skin resurfacing: histological analysis. *Arch Ophthalmol* 1999; 117: 913-916.
15. DeBacker CM, Putterman AM, Zhou L, Holck DE, Dutton JJ. Age-related changes in type-I collagen synthesis in human eyelid skin. *Ophthalmic Plast Reconstr Surg* 1998; 14:13-16.