Comparative study of non-surgical blepharoplasty by fractional CO2 laser versus plasma exeresis

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Abstract

Background: Surgical or invasive blepharoplasty has long been the gold standard for rejuvenation of upper eyelid dermatochalasis, although patients routinely experience bleeding, bruising, edema and scarring as well as the risks of serious complications such as retro bulbar hemorrhage and dryness, causing temporary or permanent loss of vision. This lead to the search for other safer alternative non-invasive methods such as plasma exeresis and fractional Co2 laser.

Objectives: Comparative study of non-surgical blepharoplasty by fractional CO2 laser versus plasma exeresis.

Patients & Methods: In this study, non-surgical blepharoplasty was done to 32 patients whose ages ranged between 30-60 years in the ophthalmic clinic placed in Baquba City, Diyala province during the period from 1st of August 2020 to 1st of February 2021. The fractional CO2 laser method was performed to 9 patients, while the plasma exeresis method was performed to 23 patients and after performing the two non-surgical blepharoplasty methods, a comparison was made

Result: In plasma exeresis, the results were as follow, well responded to the treatment is found in 16 patients (80%). Moderate response was found in two patients (10%). Poor response was found in two patients (10%). In fractional CO2 laser, the results were as follow, well responded to the treatment was found in eight patients (66.6%). Moderate response was found in two patients (16.6 %). Poor responsewas found in two patients (16.6 %). Subject satisfaction was high and the procedure was well tolerated.

Conclusion: Good outcome obtained and the choice of the method for eyelid rejuvenation depends on the doctor and the patient's desire. The fractional CO2 laser is better in terms of complications during and after the procedure regarding to pain, redness, swelling and crusting formed, as well as the time of the operation.Future studies with large sample and longer follow-up period are recommended to further evaluate the longevity of clinical benefits.

Key Words: Blepharoplasty, Plasma exeresis, Fractional CO2 laser

Introduction:

Blepharoplasty is the plastic surgery operation for correcting defects, deformities, and disfigurations of the eyelids. The procedure is more common among women, who accounted for approximately 85% of blepharoplasty procedures in 2014 in the US and 88% of such procedures in the UK [1, 2].

According to the 2016 American Society for Aesthetic Plastic Surgery statistics, it is the fourth most common cosmetic procedure performed in the United States, Numerous techniques have been described for both upper and lower blepharoplasties, with no comparative data supporting the superiority of one technique over the other [3,4].

The surgical approach is currently the gold standard approach and the postoperative healing period is typically 6 weeks [5].

While the surgical approach is preferred for cases of excess dermatochalesis and steatoblepharon and lacrimal gland prolapse and brow ptosis [6], it was found to have so many serious complication (scar, infection, keloid, granuloma) or minor complication (edema and bruises) beside needing anesthesia those last two can improve in 2 week if no bleeding occur [7, 8].

In the trans conjunctival approach to the upper lid the excess fat but not the skin can be removed [9]. The creation of a supratarsal fold ("double eyelid surgery") is aimed in young patient whereas in older patients the goals are to create or elevate the supratarsal fold and to resect surplus eyelid skin (Asian blepharoplasty since the Asian had different approach to blepharoplasty) [10, 11]. For fear of complication especially in lower blepharoplasty alternative approach was studied [12].

Clinical study focused primarily on the efficacy of treatment of non- surgical blepharoplasty conducted by the Department of Dermatology of the University of Modena and Reggio Emilia. They utilized the global aesthetic improvement scale (GAIS), to measure patient satisfaction following a non- surgical blepharoplasty. All of them reported an aesthetic improvement, from being ‘satisfied’, to proclaiming an ‘outstanding result’. A further tool was used to assess dermatochalasis, this being the Wrinkle Severity Rating Scale by Waugh &

Blitzer [13] yielded a decrease in dermatochalasis, from which severe laxity became mild, minimal or completely absent [14].

Fractional plasma is a minimally invasive outpatient procedure that needs two sessions two week apart to achieve effect. In addition, it is associated with mild lid edema and spark effect that resolves within 1–2 weeks [15].

The plasma compared to laser is more precise with less effect on surrounding skin and it can be used in the management of acne scars, wrinkles as crow's feet or smoker's lines, skin tags, milia, syringoma and dermatochalasis (blepharoplasma) [16,17].

Plasma exeresis (Plexr) is a cordless micro-surgical handled device that intensifies heat to the accumulative skin tissues. It handles the differentiation in voltage amid equipment and the patient's skin. This distinction in voltage creates a limited electrical arc, identical to a minute long lighting. The small lighting achieves sublimation of the liquids included in the superficial section of the skin, without undesirable heat transmission to nearby tissues, it is dynamic noninvasive approach in which intraop adjustment is possible like in adjustment skin color or amount of tissue removed since studies show that it is doesn't penetrate basement membrane of skin [18].

The Plexr device is used to sublimate this excess, without penetrating the membrane basal, but with only propose to target the keratinocytes. Clinical studies proved that after one month collagen type 3 is formed (baby collagen). Through this procedure, potential skin harm is decreased in contradict to traditional lasers. 'Catch' innovation of new energy design took place at the State University "Tor Vergata" Rome, in Camerino. Bloodless, without incisions and stitches, economically and with immediate effect. All this is possible by using Plasma Exeresis (Plexr®) method where there are great results especially in the sensitive region of the eyelids [16].

The mechanism of action of Plasma exeresis ionizes gases present in the spatial gap between the proximal tip of the instrument and the tissue being treated. Plasma is generated through the tip of the device in the form of an ultra-gas like state of matter, and the energy created is transferred onto the superficial skin layer. The tissue is sublimed; a direct transfer of the tissue from a solid form to a gaseousstate is created. Direct contact with the skin is avoided. Because an electric passage zone is not created, eventual electric resistance of the tissue does not influence tissue sublimation. The heat is absorbed by the tissue being treated and is not transferred to surrounding tissue or the subcutis [19].

On the other hand Laser therapy uses photon emission (with spatial and temporal coherence) to destroy, vaporize, and coagulate tissue, whereas electrosurgical/radio scalpel therapy uses radio waves to increase tissue heat,

Fractional CO2 laser, upper eyelid thinning, hooding, and drooping of the upper lid skin are common. 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 [20, 21]. Fractional continuous wave CO2 laser generates more 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 from the enhanced dermal heat [22, 23]. Laser rejuvenation of upper lid skin using continuous wave CO2 laser is low cost, noninvasive, has shorter operative and recovery times with more natural outcomes, and no scarring compared with traditional surgical techniques [24, 25].

Side effect to CO2 laser include hyper or hypopigmentation, recurrence of viral illness, scarring , infection , corneal and scleral burn if used near eye, loss of vision and ectropian which was reduced with the use of new instrument that apply on sequential microspot to decrease collateral damage to healthy tissue [26].

Newer version of CO2 lasers maximizes the rmal effect but minimizes the buildup of heat, reducing 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. And used in retinal disease as well as glaucoma [27]. 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 delicate retinal tissue [28].

Although the benefit of laser using is undeniable its mechanism of action has been debated [29]. Although fully ablative traditional and fractional CO_2 lasers have distinctive characteristics, much of the research on fully ablative CO_2 resurfacing is applicable to fractional resurfacing surgical revision of dermatochalasis is the gold standard for treatment, but can expose patients to pain, bruising, and prolonged recovery times [30].

While fat bags require surgical intervention, several options are available for periorbital skin rejuvenation [31, 32]. Carbon dioxide (CO2) laser is a laser device producing energyin the far infrared, using a wavelength of 10,600 nm. Resurfacing with CO2 laser has been used in the treatment of scars and skin aging, as well as for unconventional

applications [33]. Nevertheless, ablative CO2 laser treatment requires general anesthesia or sedation, long-lasting recovery, and can induce potential adverse events [34, 35]. However, the high efficacy of ablative CO2 lasermakes it a powerful weapon in the treatment of many skin conditions by experienced hands [36]. CO2 laser has shown a wide range of applications. CO2 micro ablative fractional laser has ~~been~~ developed to deliver controlled epidermal and dermal damage to achieve wound healing and remodeling with a short downtime [37, 38].

The CO2 laser was one of the earliest of the laser systems to appear [39]. Technological advances which continue in CO2 laser and fractionated laser development design and delivery will ensure the expand of its usage [40].

The first equipment to employ this technique was the Fraxel ®(Reliant City, US). Less aggressive non-ablative procedures do not remodel the surface of the skin significantly and can be insufficient to improve severe solar elastosis. Non- ablative lasers do not penetrate as deeply or promote as much new collagen formation as ablative that are surrounded by intact skin. The lesion depth is determined by the amount of energy supplied and the side effect is less with fractionated laser [41,42].

The aim of study is to compare non-surgical blepharoplasty by fractional CO2 laser versus plasma exeresis.

Patients & Methods:

In this study, non-surgical blepharoplasty was done to 32 patients whose ages ranged between 30-60 years in ophthalmic clinic placed in Baquba city, Diyala province during the period from 1st of August, 2020 to 1st of February, 2021 and subject consents were taken for participation. The fractional CO_2 laser method was performed to nine patients, while the plasma exeresis method was performed to 23 patients and after performing the two non-surgical blepharoplasty methods, a comparison was made.

The exclusion criteria:

Patients with symptoms of connective tissue diseases, pregnancy, history of radiation therapy or scleroderma, atopic dermatitis, patient-with koebnerizing skin diseases like vitiligo and psoriasis, recent chemical peeling, laser treatment, botulinum toxin injection, lid scar, severe dermatochalasis and deep periorbital wrinkles were excluded from our study.

Inclusion criteria:

Any patient with mild to moderate skin crease that involves upper or lower eye lid between 30 to 60 years old was included in this study.

For the fractional CO_2 laser method, the local EMLA (5%) cream was used as topical anesthesia. while for plasma exeresis procedure the local injection of xylocaine 2% was needed in addition to topical EMLA (5%) cream in most cases (90٪) . Cream of EMLA cream constitute is lidocaine 25 mg + prilocaine25 mg + polyoxyethylene ester + carboxypolymethylene + sodium hydroxide + pure water, or Xylocream, containingLidocaine + Prilocaine (2, 5 + 2, 5) % w/w and inactive substances. Use of the cream wasset every 5 minutes for 30 to 60 minutes and then the sublimation with plasma exeresis orfractional CO2 laser device was started.

Method for laser:

The fractional CO2 laser system is a class IV (includes continuous laserwith energy out put >5mW<500 mW. It means the laser which can damage by direct intra beam exposure and from specular or diffuse reflections).

Protective eye goggles (completely opaque) worm by the patient and (wet guaze placed over their eyes) and emphasis on eye closure during procedure to prevent the risk of eye damage. Physicians also used special eye glasses with special wave length filter and optical density for CO2 laser. Any polished, reflective or inflammable materials were eliminated from the laser room. Good ventilation was assured in the room and vacuum to remove a vapor. For plasma exeresis no need for safety measurement.

Methods for plasma exeresis:

All patients(females) were asked to remove any make up or any other topical remedies before treatment and to dry the area properly , contact lens if present were removed and the the area was gently cleansed and then photos were taken of their face before the treatment and in order to see the difference after the treatment (Picture 1). The next step was to apply the anesthetic cream (Picture 2), wait for 30-60 minutes until the cream act so the patient won't perceive any pain while the treatment is going on. After the action of the cream, we remove it and apply the technique first on the right eyelid (Picture 3) and then on the left (in the most cases 90% we used xylocaine injection 2%).The point where there is excess skin are sublimated. We did not enter wrinkles but areas of excess skin. For the machine to operate, it should not touch the skin as ionization gas are needed, so while the micro spots were pulled out, we leave little spaces of healthy tissue.

All patients(females) were asked to remove any make up or any other topical remedies before treatment and to dry the area properly , contact lens if present were removed and the the area was gently cleansed and then photos were taken of their face

before the treatment and profile in order to see the difference after the treatment. The next step was to apply the anesthetic cream, waiting for 30 minute until the cream act so the patient won't perceive any pain while the treatment is going on. After the action of the cream, removing it and apply the technique first on the right eyelid and then on the left. Laser output Power from (10-14) watts. Laser action time duration was (1.1 ms) in each point during the scanning process. The interval between point and next point was (1 ms) during the scanning process. The distance between fractional points was (1.3 mm), to control dot matrix density.

Results

Plasma exeresis

The total number of patients is twenty-seven patients; seven of the patients did not attend the second session for unknown reasons and did not complete the treatment.

Twenty patients underwent the plexor procedure for the upper and lower eyelids, and the results were as follows: well responded to the treatment is found in 16 patient (80%).2-Moderate response was found in two patients (10%). Poorly responded was found in two patients (10%). Undesirable effect were reported mainly erythema was founded in 16 patient (80%). Mild to moderate swelling for

5-7 days after treatment this was found in allpatient 100 % resolved well by systemic antihistamine with local steroid ointment. Crusting and erosion was found in all patient (100%). Mild itching that persists for one week after treatment was found in fifteen patients (75%). Fortunately no infection reported in this study. The procedure was comfortable by topical anesthesia cream (EMELA) with local Xylocaine (lidocaine HCl) 2% injection. 90% of patient can not tolerated this procedure with topical EMELA cream only. The time for this procedure 30-45 minutes (Figure 1).

Fractional CO2 laser

The total number of patients is twenty patients. Eight of the patients did not attend the second session for unknown reasons and did not complete the treatment.

Twelve patients underwent the fractional CO2 laser procedure for the upper and lower eyelid wrinkles and the results were as follows.

Well responded to the treatment was found in eight patients (66.6%). Moderate response was found in two patients (16.6 %). Poorly responded was found in two patient (16.6 %). Undesirable effect was report mainly: Erythema was found in 10 patients (83%). Mild to moderate swelling for 24-72 hours after treatments in 6 patient 50%these started after session with in few minutes this resolved well by systemic antihistamine. Erosion and Crusting noticed in four patients (27.3 %) which controlled by topical antibiotic. Mild itching that persist for one week after treatment was founded in five patient (41.3%) (Figure 1).

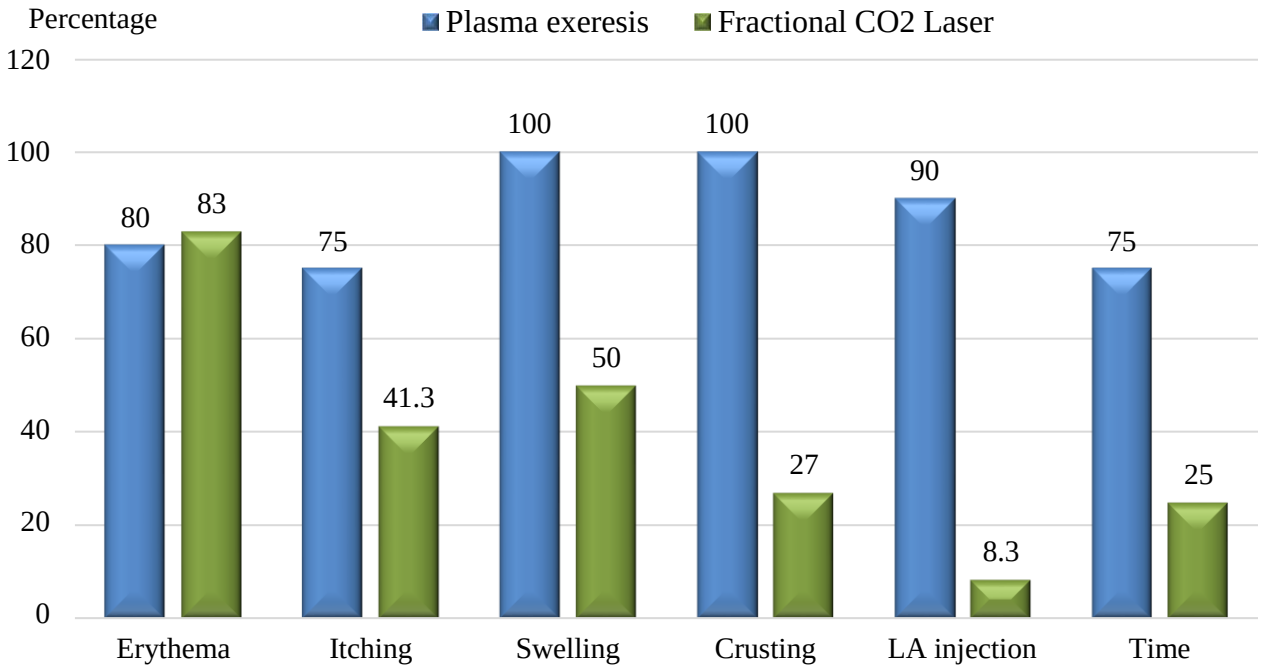

Figure 1: The comparison between plasma and fractional CO2 Laser

This procedure was comfortable apart from mild discomfort experienced bythree patients (25 %). This procedure done under LA (EMELA) with no need for local Xylocaine (lidocaine HCl) 2% injection and the time of this procedure was 10- 15 minuteonly.

In both methods we measured the results in terms of the change in elevation ofthe upper eyelid marginal reflex distance, the upper lid crease position, palpebrallid fissure distance from baseline and photo before and after the operation.

Discussion

Surgical or invasive blepharoplasty has long been the gold standard for rejuvenation of upper eyelid dermatochalasis, although patients routinely experience bleeding, bruising, edema, scarring, and downtime as well as the risks of serious complications such as retro bulbar hemorrhage and dryness, causing temporary or permanent loss of vision.

The need of the physician to provide improved innovative non-invasive techniques to patients with less pain and cost, but also the need of the patient for cosmetic procedures that prevented them from surgery.

The major advantage of plasma exeresis and fractional CO2 laser is security that it provides to the patient in desirable effects.

Continuous wave micro-spot lasers are known to generate greater amounts ofnon-scarring heat within skin to stimulate skin to naturally tighten both immediately and long term and improve texture and resistance to gravitational effects in the other hand plasma exeresis shows promising remodeling effects on the collagen of the upper-and lower eyelid and seems to improve appearance.

Both Procedures can be performed in the office and outside of traditional operating rooms, reducing costs to both patients and practitioners. These methods provides decreased recovery period, higher safety, 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 fractional CO2 Laser and plasma exeresis in patients with dermatochalasis with a follow period of 6-month .

This was proved by the results of the 32 incidents were subjected to bloodlessblepharoplasty with Plasma exeresis and fractional CO2 laser.

The plasma method is more effective in removing eyelid wrinkles and tightening the skin, compare to fractional CO2 laser but the plasma method requires a long time (30-45) minutes for the procedure while fractional CO2 laser need less than 15 minutes. In plasma method most patients, 85% of patients cannot undergo the operation using topical anesthesia with EMLA cream and they need local Xylocaine (lidocaine HCl) 2% injection and subject had oedma and swelling with crusting similar to what found in Célia et al [43].

As for the fractional CO2 laser method, more than (90%) of patients can do the surgery with EMLA cream anesthesia only.

Inflammatory response redness, swelling and pain after the operation is more severe and needs a long period of healing and this causes several inconvenience for patients.

The crusting post procedure occur in all patient (100%) with plexr but in fractional CO2 occur only in (27.3 %) and the subjects had less inflammatory symptom such response also observed in DAVID et al [44].

In conclusion, Good outcome was obtained and the choice of the method for eyelid beautification depends on the doctor and the patient's desire. The fractional CO2 laser is better in terms of complications during and after the procedure regarding to pain, redness, swelling and crusting formed, as well as the time of the operation.

It is recommended to do more future research with larger size and long period of follow up to further evaluate the longevity of clinical benefits.

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