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Modern blepharoplasty: From the bench to the bedside

Miotti G *et al.* Modern blepharoplasty

Abstract

The demand for procedures aiming to rejuvenate the upper third part of the face and the periocular region has increased in the past several years. Blepharoplasty is one of the most frequently performed procedures worldwide to date. Surgery is currently the first choice in order to achieve permanent and effective results, however, it is burdened by potential surgical complications feared by patients. There is an increasing trend in individuals to request less invasive, non-surgical, effective, and safe procedures for eyelid treatment. The aim of this minireview was to present a brief overview of non-surgical blepharoplasty techniques that have been reported in the literature in the past 10 years. Numerous modern techniques that provide a rejuvenation of the entire area have been described. Numerous less invasive methods have been proposed in current literature and in modern-day routine clinical settings. Dermal fillers are a commonly chosen option for providing enhanced aesthetic results, especially considering that volume loss can be one of the main underlying causes of facial and periorbital aging. Deoxycholic acid use may be considered when the problem is represented by periorbital excess fat deposits. The simultaneous excess and loss of elasticity of the skin can be assessed with techniques such as lasers and plasma exeresis. Furthermore, techniques such as platelet-rich plasma injections and the insertion of twisted polydioxanone threads are emerging as viable methods to rejuvenate the periorbital region.

Key Words: Non-surgical blepharoplasty; Laser treatment; Dermatochalasis; Aesthetic; Non-invasive procedures; Hyaluronic acid; Plasma exeresis; Eyelids

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Core Tip: Non-surgical procedures represent a valid alternative to surgery in the rejuvenation of the periorbital area. When the problem can be corrected by 'filling' more

and 'removing' less, fillers may be of use. Laser treatment and microsurgical techniques can provide a viable solution when the main concern is based on excess and/or inelasticity of skin.

INTRODUCTION

The periocular region represents one of the most fascinating and interesting elements of the face that others usually first notice in us. The first signs of aging of the face are typically seen in this area^[1]. The search for a younger and "fresher" appearance of the face is one of the main reasons that individuals search for clinical assistance, be it surgical or non-surgical. The demand for upper facial rejuvenation in both females and males has dramatically increased in the past decade. Blepharoplasty, which is performed for cosmetic and/or functional reasons, is one of the most performed procedures worldwide^[2]. In the last 10 years, blepharoplasty has been one of the top five most commonly performed surgical procedures, along with facelift (rhytidectomy) and rhinoplasty^[3].

Blepharoplasty can be defined as the surgical repair or reconstruction of the upper and/or lower eyelids. These procedures are performed to correct the signs of aging that occur in the periorbital region and enhance unaesthetic lids. The procedure typically involves the management of excess eyelid skin, lid laxity, ptosis, orbital septum, and orbital fat. Upper and lower lid blepharoplasty can be performed for cosmetic reasons and/or reconstructive reasons. Cosmetic and reconstructive procedures can be undertaken at different times or can sometimes be performed during the same operation^[4,5].

The upper and lower eyelids consist of ⁴ anterior, middle, and posterior lamellae. The anterior lamella is composed of skin and orbicularis oculi muscle of the eyelid, whereas the posterior lamella refers to the retractors, superior or inferior tarsal muscle, tarsus, and conjunctiva. The orbital septum is sometimes referenced as the middle lamella^[6]. Despite being one of the most frequently performed operations, surgical blepharoplasty tends to be an invasive and non-definitive procedure that can produce scars and may

require further surgical retouches in the future. Like all surgical procedures, blepharoplasty involves risks that include infection, bleeding, and other post-operative complications. In light of the fears and risks involved with traditional invasive surgery, there has been an increasing demand for innovative cosmetic procedures that are less invasive and provide good outcomes with fewer side effects compared to surgical procedures^[2]. The aim of our minireview was to present a brief overview of non-surgical blepharoplasty techniques, which have been reported in the literature and used in clinical settings in the past 10 years.

MATERIALS AND METHODS

We conducted a search of the literature published between January 1, 2012 to December 1, 2022 using MEDLINE (PubMed). The database was first searched using the key words “non-surgical blepharoplasty, blepharoplasty NOT surgery, non-surgical blepharoplasty techniques, non-invasive blepharoplasty, blepharoplasty AND fillers, blepharoplasty AND hyaluronic acid, blepharoplasty AND laser, blepharoplasty AND peeling, blepharoplasty AND chemical peels, blepharoplasty AND plasma”. We considered only studies in English and those referring to humans and with an abstract, thus reducing the count to 538 papers. The reference lists of all retrieved articles were assessed to identify additional relevant studies. The research of articles was performed using PubMed (<https://pubmed.ncbi.nlm.nih.gov>) and *Reference Citation Analysis* (<https://www.referencecitationanalysis.com>).

Only articles with an abstract were considered. After excluding all works in which only surgical techniques were described and those that assessed non-surgical techniques as only complementary to surgery, 40 studies were analyzed. A quality score was calculated for each article using a check list from the American Society of Plastic Surgeons guidelines for therapeutic studies^[7]. Each study was independently assessed by at least two reviewers (Miotti G and Zeppieri M), and rating decisions were based on the consensus of the reviewing authors. The results of the most relevant studies are shown in Table 1.

BACKGROUND

Like any surgical procedure, blepharoplasty, especially performed on the lower one, is burdened by potential complications such as dry eye syndrome, corneal abrasion, lid asymmetry, ¹³lagophthalmos (the inability to close the eyelids completely), lacrimal gland injury, canthal webbing, postoperative hemorrhage, diplopia or infection, blepharoptosis, wound dehiscence, scleral show, ectropion, *etc*^[8-11]. In the past several years, there has been an increasing demand in enhanced aesthetic outcomes with procedures that can offer quicker operative and postoperative wound-healing times, and preferable with fewer complications and discomforts with anesthesia. Non-invasive, and less invasive procedures have become relatively popular in providing effective and safe alternatives for eyelid treatment. There has been great interest in those techniques that can guarantee good outcomes, while minimizing the side effects usually associated with surgical procedures^[2].

When we talk about non-surgical procedures for treating the periocular region, we must consider all the emerging techniques that determine a rejuvenation of the entire area (*i.e.*, techniques for volumizing or reducing unwanted localized fat deposits), and not only those based on surgical approaches to redundant skin or fat pads. Techniques such as hyaluronic acid (HA) fillers, lasers, deoxycholic acid and plasma exeresis are considerably emerging, providing interesting and viable options in aesthetic treatments of eyelids^[12].

The dynamics of eyelid aging are not completely known to date. They are characterized by various physiological processes that lead to inelastic and excessive skin and/or subcutaneous soft tissue or bone volume loss^[1,13,14]. Due to the emerging evidence from studies based on the dynamics of periocular aging and the concept of beauty (empty eyelid *vs* full eyelids), surgical approaches have evolved and changed over time to meet the new demands of individuals. Plastic surgery in this specific field has gone from a subtractive surgery approach to modern-day augmentation blepharoplasty techniques, in which adipose tissue is repositioned or even increased

(i.e., lipofilling, HAs, *ect*)^[1,15]. The following sections of the manuscript will briefly deal with the different conservative options for eyelid rejuvenation.

LASERS

One of the most characteristic aspects of eyelid aging is represented by the simultaneous excess and loss of elasticity of the skin. Laser treatment has shown to provide interesting options to address these morphological and functional changes of the lid. The objective of laser treatment is to ensure a contraction of the skin, which can give rise to a smoother and toned appearance^[16]. Before promoting any treatment, it is fundamental to understand the mechanisms of aging and needs of each individual patient seeking aesthetic procedures to enhance facial appearance. In addition to changes to the skin, fat pads, muscle or bone tissue can be affected by aging processes^[1]. The laser approaches that are typically considered in these patients include resurfacing, ablative or non-ablative techniques. Laser treatments can also be used to complete and enhance traditional blepharoplasties surgical procedures^[16].

There are several different laser technologies that can be used for the treatment of the eyelid region, which include: Ablative CO₂ laser; erbium-doped yttrium-aluminum-garnet (Er:YAG) laser; fractional ablative CO₂ laser; fractionated erbium:YAG laser; and, non-ablative fractional laser^[16,17]. Fractionated ablative laser treatments target water and cause selective photothermolysis^[17]. The main differences between ablative and non-ablative lasers are the layers of the skin affected, laser dosage and efficacy, which tends to be greater for ablative ones. Ablative lasers usually present a longer recovery time and involve greater risks. The selection of the appropriate laser device is fundamental, which should be based on the morphological and functional characteristics of the areas to be treated, the clinical needs of the patient, and the postprocedural recovery time. Fractionated lasers typically have a faster skin-healing time and reduced risk of scarring, dyschromia, and postprocedural infections.

When dealing with patients that seek blepharoplasty for enhanced lid aesthetics, the clinician should provide various pertinent options for each individual, by specifying all

details regarding pros, cons, risks, and expected outcomes and healing times. Complete clearly understood information is necessary in obtaining written informed consent before surgery. Nguyen *et al*^[18] nicely reported how patients mistakenly believed that laser blepharoplasty was better than the traditional one (because it is considered simpler, less painful and with a shorter recovery). The study shows how the advice given by physicians can have a huge impact on decisions made by patients. It is thus of utmost importance that clinicians be careful and complete in explaining all options, and should avoid setting false expectations when dealing with patients^[18].

¹⁵ Historically, ablative CO₂ resurfacing has been the gold standard for skin resurfacing. This laser has been described to provide an effective approach to treat the dermatochalasis of the eyelid skin because it was believed to be better at giving tissue contraction and rhytid improvement than Erb:YAG ablation^[17]. Fitzpatrick *et al*^[19] demonstrated that both CO₂ laser and Er:YAG laser have similar degrees of tightening, however, Er:YAG laser showed 33% of scarring in patients and a lower ability of coagulation when compared with CO₂ laser. The manuscript by Bae-Harboe *et al*^[16] provides a careful analysis of advantages, disadvantages and potential side effects of ablative, ablative-fractioned and non-ablative techniques. The study also shows that fractioned ablative CO₂ laser represents a valid solution to improve the appearance of periocular area.

With regards to patients with eyelid skin excess, several studies have reported the positive use of laser for mild or moderate cases of dermatochalasis. Toyos^[20] published a study based on 16 patients affected by mild dermatochalasis and treated with fractional continuous wave CO₂ laser. The study showed an increase in the common lid measurements for dermatochalasis and skin laxity at the follow-up at 6 mo and fewer side effects, which tended to be only minor. Balzani *et al*^[21] provided satisfying outcomes with CO₂ laser. The study was based on 20 patients treated at upper eyelid and eyebrow regions with fractional ultrapulse CO₂ laser. The mean lid lift after treatment was 1.63 ± 0.68 mm and 2.300 ± 0.67 mm at 6 mo, respectively. Fractional ultrapulse CO₂ laser reduces collateral thermal damage through selective skin

vaporization and causes tissue tightening and collagen shrinkage. This laser technique tends to show low costs, low risks and with short operative and recovery times. Garcia and Badin^[22] retrospectively analyzed 263 patients with mild inferior dermatochalasis treated solely with ablative fractioned CO₂ laser. They showed an improvement in the eyelid area characterized by fewer rhytids and a younger appearance 6 mo postoperative. The treatment of the lower eyelid has also been shown by Guida *et al*^[23]. They retrospectively considered 20 patients treated with freehand CO₂ ablative resurfacing, using the technique of resurfacing with ablation of periorbital skin. Results demonstrated an increase in the Global Assessment Improvement Scale (subjective and objective) and a reduction of medium protrusions and depressions, with an improved texture at 2 mo that was confirmed with 3D image reconstructions. The histological explanation of what happens to the skin after a laser treatment has been reported in a recent article by de Filippi Sartori *et al*^[24] published in 2022. The study showed an increase of skin collagen I and III concentrations 30 d after resurfacing treatment performed with fractioned CO₂ laser, with an evident improvement in periorbital rhytidosis.

Another element that patients typically seek consultation is for periorbital hyperpigmentation. Various treatments can be performed for this unsightly condition, including laser. The etiology can be linked to pigmentary, structural, vascular, and/or mixed causes^[25]. Vreck *et al*^[26] and Samaan and Cartee^[27] have carried out a thorough analysis of the all-possible solutions for this problem, providing three possible solutions using lasers. The first option exploits the Q-switched laser, which is ideal for selectively treating melanosomes while causing minimal trauma to the surrounding structures. The evolution of technology has led to the experimentation of the laser Nd:Yag, which can penetrate deep into the skin and have minimal effects on melanosomes, allowing increased safety when treating more pigmented individuals, such as Fitzpatrick type V and VI skin. The second treatment option is based on pulsed dye lasers, which are useful for individuals that have dark circles with a vascular etiology. The last option, which tends to be considered as the most effectiveness, is based on ablative or

fractionated laser resurfacing. When comparing CO₂ and Erb:YAG technologies, the latter option tends to offer ¹ more precision with a more limited depth of penetration and minimal thermal damage. Fractionated laser technology reduces the confluent thermal damage when compared with ablative lasers. This determines the presence of ¹ behind untreated skin, which allows for less downtime and a lower complication rate. As already reported by other reviewers, such as Vrcek *et al*^[26], ⁶ the results of fractionated CO₂ laser resurfacing have been shown to be comparable with traditional ablative resurfacing, however, with a lower rate of complications and less downtime. Given its bias of being an uncontrolled cohort study, similar results have also been reported in a paper published by Garcia and Badin^[22].

With regards to possible complications related to laser treatments, the incidence generally tends to be low and minor. Patients should be informed of the possible onset of edema, swelling, hypo or hyper-pigmentation, infections (bacterial or viral), visible scarring (that can give rise to ectropion if severe). One of the largest series in the literature that focuses on complications after laser treatment includes the study by Kim *et al*^[28] using fractional ablative CO₂ laser resurfacing. The results show low risk of infection, which was limited to less than 1%, with a prevalence of viral etiology (4 viral cases *vs* 2 bacterial cases). Hyperpigmentation caused by post-treatment inflammation was the most common complication, which was found in about 10% of patients, however, easily with topical medical therapy. Visible scars were reported in 0.9% of cases that needed steroid injections. The study showed a grade of “very satisfied” (or more) in global post-treatment satisfaction in about 97% of the patients treated.

PLASMA EXERESIS

When a patient refuses a surgical approach to correct the signs of eyelid aging, the plasma exeresis technique can be proposed as a viable option. The plasma technique is becoming an increasing interesting non-surgical alternative for the treatment of dermatochalasis. It ² consists of a handpiece producing ionized energy from an air gap that causes superficial tissue heating without any direct contact. A controlled and

limited thermal damage transforms solid tissue into a gaseous state that creates mild coagulation, resulting in increased collagenosis and contraction of the skin.

Plasma technology is considered as a safe and efficient non-surgical option. There have been only a few minor complications reported in literature, which include delayed healing, skin bacterial infection, herpes simplex virus infection, tissue scarring, and post inflammatory hyperpigmentation (most common). Easy precautionary measures can be applied, such as those reported by Ziade and Desiree^[29] to reduce risks. Studies by Rossi *et al*^[30] have given possible histological explanations as to what happens to the skin after treatment with plasma technology. Treatment appeared to induce a change in the conformation of the collagen fibers observed with confocal microscopy, going from huddled and coalesce presentation to form long and straight fibers. There were no major side effects observed.

Ferreira *et al*^[31] showed promising results in a cohort of 16 patients that underwent upper blepharoplasty using plasma technology. What emerged in this prospective study is both a general post-treatment satisfaction (calculated by modified Q-bleph) and a limited number of adverse events (hyperpigmentation was one of the possible side effects in patients with Fitzpatrick III-IV phototype, but was easily resolved). Rossi *et al*^[30] and Verner *et al*^[32] showed effective and comparable results in patients treated with plasma exeresis for upper eyelid dermatochalasis. Hassan *et al*^[10] found a statistically significant decrease in eye lid laxity after treatment in a study based on 40 patients treated with this method. Studies by Baroni^[2] showing effective treatment and good aesthetic results were based a long-wave P-RF ablation plasma device to treat 10 patients affected with dermatochalasis. His protocol consisted of two treatments distanced one month apart. The general satisfaction of patients was quite good (8 > VAS scale), with no reported permanent side effects. High levels of satisfaction (about 80% of both patients and investigators) were reported in a prospective study by Giroux *et al*^[33]. They treated 25 patients affected by moderate dermatochalasis, and obtained a mean lid reduction of about 2.5 mm 12 mo follow-up.

Studies in current literature also report the possible use of plasma technique for treating periocular hyperpigmentation, as well as dermatochalasis and wrinkles^[34]. A pilot study carried out by Theppornpitak *et al*^[35] reported effective and positive clinical outcomes in mild and moderate cases of periocular hyperpigmentation.

DERMAL FILLERS

In the field of facial rejuvenation, dermal fillers have been widely used for numerous years. They have recently become an alternative to surgical procedures for both aesthetic and functional indications, such as upper and lower blepharoplasty, tear-trough deformity for the lower lid, lagophthalmos, orbital volume deficiency, upper and lower eyelid retraction and eyelid malposition. Dermal fillers represent a valid alternative to surgery in aesthetic indications. Injectable fillers provide numerous advantages that make them a suitable alternative to surgery, considering that they are minimally invasive, titratable, repeatable and, in some cases, reversible. Soft tissue fillers/injectables can be classified based on their source, which include autologous (fat), biological (collagen and HA) and synthetic [poly-L-lactic acid, calcium hydroxyapatite and polymethylmethacrylate (PMMA)]. Fillers can also be classified according to the duration of cosmetic benefit in short (< 3 mo, bovine collagen), medium (3-12 mo, HA), long lasting (12-24 mo, calcium hydroxyapatite, poly-L-lactic acid) and very long lasting (PMMA, fat). There is also a distinction that can be made based on their reversibility, which include fillers that are reversible (bovine collagen, HA) and irreversible (PMMA, calcium hydroxyapatite, poly-L-lactic acid, fat)^[36].

HA

HA derivatives are the most commonly used dermal fillers especially considering that it is a ubiquitous molecule in the human body, thus do not require allergy testing prior to use. HA derivatives display a medium to long duration (6-12 mo) thanks to their cross-linking to other chemicals that prevents biodegradation from enzymes. A wide variety

of HA derivatives displaying different characteristics have been produced over the years, leading to the abundant use in variety of fields of surgery, such as in the management of periocular and orbital pathology^[36].

Lagophthalmos is defined as the inability to fully close the eyelids due to paralysis of orbicularis oculi (paralytic), retraction of upper or lower lids (restrictive) and proptosis. This important lid disorder can result in exposure of the cornea and lead to severe dry eye syndrome and keratopathy. Paralytic lagophthalmos can be treated using HA gel (such as Restylane or Juvéderm Ultra) ³ injected in the pretarsal and/or prelevator aponeurosis regions along the length of the upper eyelid and deep to orbicularis oculi muscle in a feathered layered fashion, as demonstrated by two retrospective studies conducted separately by Mancini *et al*^[37] and Martín-Oviedo *et al*^[38]. The use of HA gel in the treatment of lagophthalmos ³ is ideal for patients not suitable for surgery and those unable to tolerate an external weight applied to the lid. HA provides a flexible and temporary approach that can be ideal to treat reversible and non-permanent causes of lagophthalmos.

HA gel injections are an effective non-surgical treatment for upper eyelid retraction. Studies by Kohn *et al*^[39] showed how multiple subconjunctival injections of Restylane- L in the elevator aponeurosis plane in patients with active thyroid eye disease, led to a reduction in marginal reflex distance-1 that persisted for a mean of 15 mo post-injection. Leyngold *et al*^[40] reported good clinical outcomes in patients with sunken superior sulcus, in which injections of Juvéderm Ultra XC in the superior sulcus deep to the orbital septum led to a 70% decrease of lagophthalmos at the longest follow-up with a mean 9.5 mo^[40].

Lower eyelid retraction secondary to different aetiologies can also be treated with HA gel injections, as demonstrated by Xi *et al*^[41]. The study was based on injecting HA under the orbicularis muscle in 27 cases and evaluating the results by the standardized marginal reflex distance 2 (MRD2). The retraction resulted completely corrected in ¹⁰ 96.3% of patients with no recurrence at 9 mo post-injection, showing an improvement of

the standardized MRD2 of 0.84 mm immediately after injection and 1.19 mm nine months later^[41].

Romero *et al*^[42] analyzed the effects of HA injections in the primary management of cicatricial ectropion, which can be defined as the eversion of the eyelid away from the globe due to the shortening of the anterior lamella secondary to many conditions including surgery and trauma. The authors injected 1 mL of Restylane in each eyelid along the infraorbital rim, in preseptal area and in the infraciliary region, obtaining improvement in the eyelid position in all patients with at least partial ectropion correction. Since this technique provided a poor cosmetic outcome in some of the cases treated, the authors suggest to consider this treatment in patients who are poor surgical candidates.

A recent retrospective case review conducted by Bladen and Malhotra^[43] considered the use of HA in the treatment of epiblepharon in pediatric patients as an alternative to traditional surgery, since this condition usually shows an improvement as the child grows older. Of 8 eyelids treated with Restylane, 6 showed improvements with an 87% success rate, making HA injection a feasible option for the treatment of epiblepharon, with the advantage of avoiding or delaying surgery in selected cases.

The safety profile and variety of HA derivatives have rendered these dermal fillers suitable for various aesthetic use, including periorbital area rejuvenation. There has been a paradigm shift over the last two decades in this field of aesthetic medicine considering that the understanding of volume loss has been recognized as one of the main causes of facial and periorbital aging, determining symmetric or asymmetric hollowing, excess upper lid showing and dermatochalasis^[12,44]. As a result, volume restoration has become a preferred approach in order to achieve natural rejuvenate results. HA derivatives seem to ideal candidates for this methodology, considering that they do not require surgery, are quick to perform, reversible within minutes, and display medium to long lasting effects. HA injections in the upper eyelid and superior orbital region are performed in order to improve the aesthetic appearance in patients presenting with superior sulcus hollowness, which may be secondary to the aging

process or iatrogenic after excessive fat removal during surgical blepharoplasty^[45]. Filling the upper eyelid can provide improvements in eyelid closure and function in select cases. In two studies conducted by Romeo^[46], upper eyelid area filling with HA was compared to surgical blepharoplasty as means of reaching eye rejuvenation in a cohort of 154 and 500 patients respectively. Both studies showed high patient satisfaction in regards of the aesthetic endpoint and long-lasting results in a 12 mo follow-up, defining HA filling as an effective means of rejuvenation for the upper eyelid that can be used independently^[12].

Another application of HA injection in the periorbital area is represented by the treatment of tear trough deformity (TTD) of the lower eyelid. In these cases, the filler is placed at the preperiosteal plane below orbicularis muscle. ⁸ The tear trough is composed of thin skin adherent to the orbicularis muscle that is attached to the orbital rim. In young patients, the tear trough is located in the medial third of the orbital rim, whereas in ageing individuals, it gradually extends laterally up to the lateral canthus^[44]. Jiang *et al*^[47] compared the use of HA gel to autologous fat injections and fat repositioning surgery *via* arcus marginalis release for the treatment of TTD in 78 patients. Results showed that HA fillers may be used alone in the treatment of TTD in ¹ patients with mild to moderate periorbital volume loss without severe orbital fat bulging. An observational study by Diaspro *et al*^[48] involving 600 patients showed that HA injection alone can be considered for the treatment of TTD in patients between 30 and 40 years of age, based on the statistical analysis that showed an inverse correlation between age and aesthetic outcome.

Other injectables

PMMA is a synthetic, extremely long lasting and potentially irreversible filler. In a retrospective case series enrolling 289 patients, Mani *et al*^[49] analyzed the use of PMMA microspheres in the infraorbital eyelid area for the treatment of rhytids. Results showed subdermal PMMA microspheres injection to be a safe technique in the correction of infraorbital rhytids, with results that seem to be predictable and natural. Only 4 patients

developed late minor complications in the form of small granulomas, which resolved with the intralesional injection of triamcinolone. A correlation between granulomas formation and previous lower blepharoplasty was found^[49].

Sodium deoxycholate (DC) is another injectable substance that may be taken into account in periorbital area rejuvenation procedures. DC has been widely used to reduce unwanted localized fat deposits for many years. The treatment of lower eyelid fat pads with monthly injections of sodium DC 1.25% (DB125) was evaluated by Amore *et al*^[50] in a multi-center observational prospective study on 120 patients with the aim of assessing the safety and effectiveness of DB125. Results showed a moderate to high patient satisfaction and therapeutic success in 85.83% of the patients enrolled with no significant differences between sex, a high degree of effectiveness, and minimal adverse events. This procedure, however, should be considered for the treatment of lower eyelid fat pads in patients preferably under the age of 40, since higher success rates in studies tend to be reported in the younger age groups^[50].

Polydioxanone threads

Infraorbital groove correction may be achieved with different techniques, such as filler injections, lower blepharoplasty and microfat grafting. A new technique to achieve facial rejuvenation is represented by the insertion of transcutaneous synthetic threads for infraorbital groove correction, such as multiple twisted polydioxanone (PDO) threads. Lee *et al*^[51] examined the efficacy and the risks of this technique on a group of 40 patients aged 25-56 years old assessing Barton's grading and Global Aesthetic Improvement Scale scores and patients' satisfaction. Results showed a significant and persistent improvement in the mean Barton grade, hence indicating the effectiveness and the benefits of this technique, with no significant concerns about safety. More than 77.5% of patients were satisfied with the outcomes^[51].

Platelet rich plasma

Another option available for the treatment of the lower eyelid area has been investigated by Aust M *et al* (52) The authors evaluated the use of platelet rich plasma (PRP) in order to rejuvenate the skin of the lower eyelid region and treat actinic elastosis. The study enrolled 20 patients who received three 2 mL PRP injections per side in the lower eyelid area at monthly intervals. The endpoints were evaluated using a cutometer to measure skin elasticity and questionnaires to objectify patients' satisfaction. Results showed a statistically significant increase in skin firmness and skin elasticity, as well as a high level of patient satisfaction and progressive improvement of the aesthetic outcomes. Side effects were minimal and only represented by swelling after the PRP injection, while the procedure was reported to be pain-free.

CONCLUSION

The eyelid region has always been and will continue to represent a fundamental part of the face that provides treatment options geared at improving aesthetic outcomes and younger age-related effects. There are numerous methods, techniques and tools currently available, which can provide improvements in mild and moderate cases. Surgery tends to be the first choice to provide radical and long-term effects, especially in severe cases. Less invasive and non-surgical options have been of increasing use in the past decade, especially considering the possibility of obtaining a comparable result by limiting risks, complications and healing times. New less invasive methods, lasers, innovative technologies and alternative tissue fillers are destined to pave the way to the future in modern aesthetic medicine.

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