

Periorbital rejuvenation in the clinic: A state-of-the-art review

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Abstract

Objective: To provide an overview of the various treatment options available in the clinic to achieve periorbital rejuvenation.

Data Sources: Literature review and expert opinion.

Conclusions: Periorbital rejuvenation in the clinic can be accomplished through a variety of treatment modalities, including topical therapies, skin resurfacing, and fillers and injectables. Furthermore, some surgical approaches, such as upper blepharoplasties, ptosis, and brow lifts, can be performed in the clinic under local anesthesia with only mild oral sedation. However, the successful execution of such procedures depends on proper patient selection and maximizing patient comfort.

KEYWORDS

blepharoplasty, chemexfoliation, laser therapy, rejuvenation, skin aging

Key points

- This study provides an overview of treatment options for patients seeking periorbital rejuvenation while avoiding general anesthesia.
- This review discusses the risks and benefits of various nonsurgical and surgical rejuvenation procedures, and it provides recommendations for the incorporation of these procedures in the clinical setting.

INTRODUCTION

The upper third of the face, generally consisting of the forehead, brow, upper and lower eyelids, and temple region, is one of the first areas of the face to show age-related changes. Broadly, signs of aging are genetically determined but are accelerated by damage from sun exposure, repeated facial expressions, and cigarette smoking, which accelerate the loss of hyaluronic acid (HA), collagen, and elastin, and thus increase skin laxity.¹⁻⁴ In the periorbital region, this leads to the formation and deepening of

periocular, glabellar, and forehead rhytides, descent of the brows, hollowing of the temples, dermatochalasis of the upper and lower lids, fat pseudo herniation of the lids, involutional ptosis, deepening of the superior sulcus, elongation of the lower lid, photoaging, and hyperpigmentation. Periorbital rejuvenation aims to restore volume, minimize and soften rhytides, and improve skin texture and coloration. In this paper, we provide an overview of treatment options available for periorbital rejuvenation that are amenable to implementation in the clinic setting, and we discuss the risks and benefits of each therapy.

[Correction added on 24 August 2023, after first online publication: CONFLICT OF INTEREST section is updated.]

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DISCUSSION

Practice management

While a complete review of practice management is beyond the scope of this article, some general recommendations relate to the information presented herein. Depending on the practice setting and available resources, the surgeon may perform many of the following therapies themselves; however, as the surgical practice matures, many of the “less risky” procedures are delegated to licensed medical estheticians (LMEs), nurses, physicians' assistants, or other ancillary providers. Individual-state regulations often dictate which procedures fall within the scope of practice for each ancillary provider. In general, we recommend that each staff member be given the education and opportunity to “operate near the top” of their scope of practice. In the senior author's experience, having practiced in all settings—academic, private (solo and group)—staff turnover is minimized if they are given these responsibilities, making the return well worth the financial and time investment. This delegation also allows the surgeon to operate at the top of their scope of practice.

Topical therapies

Numerous topical therapies can be employed either alone or in conjunction with other treatments described here to minimize periorbital aging. Sunscreens are vital to limiting the accelerated aging that results from ultraviolet (UV) radiation.^{5,6} When selecting sunscreens over the counter, patients should choose those offering broad-spectrum protection against both UVA and UVB rays. As UV radiation creates free radicals that damage protein structure, DNA, and cell membranes, topical antioxidants can help counteract associated UV damage by scavenging free radicals.^{3,5} Biologically active vitamin B3, or niacinamide, has been shown to reduce hyperpigmentation and fine lines while improving skin texture.⁷ Vitamins C and E decrease the formation of sunburn cells, the epidermal keratinocytes that undergo apoptosis due to UV damage,⁸ and the appearance of wrinkles, and these vitamins have a synergistic effect when used together.⁵ Available both over-the-counter and by prescription, retinoids, which biologically behave similarly to vitamin A, enhance collagen synthesis, limit collagen degradation, and improve skin smoothness.⁹ However, more potent retinoids can cause irritant dermatitis and should be used with sun protection. Patients should be followed regularly by a provider (in our practice, an LME) to ensure compliance, monitor progress, and evaluate for adverse effects.

Skin resurfacing

Chemical peels

Chemical peels provide a reliable method for treating rhytides, photoaging, hyperpigmentation, and scarring. By varying the concentration and agent used in the peel, providers can control the depth of

treatment, which is particularly important when treating the thin skin around the eye. All agents and concentrations induce exfoliation and subsequent collagen formation and skin tone lightening.¹⁰ Fitzpatrick skin type should be considered when selecting the depth of therapy, as patients with types IV–VI have a higher risk of dyspigmentation following treatment, particularly with deep peels.¹¹

Superficial chemical peels are best used for epidermal dyschromia and mild photoaging.^{1,3} Because the effects of superficial peels are largely limited to the epidermis, they can be used on all skin types with low risk for posttherapeutic dyschromia. Treatments are typically conducted multiple times several weeks apart. Agents and concentrations include 10%–30% trichloroacetic acid (TCA), 20%–50% glycolic acid, and Jessner solution, a mixture of salicylic acid, resorcinol, and lactic acid in ethanol.¹⁰ Typically, side effects are minimal and are limited to a temporary burning/stinging sensation, local irritation, and erythema.

Medium-depth chemical peels treat beyond the epidermis and reach the superficial reticular dermis.¹⁰ This allows medium-depth peels to improve moderate photoaging, mild wrinkling, and blending of the transition between the periorbital and facial skin. Agents for medium-depth peels include 35% TCA in Jessner solution, solid carbon dioxide, 70% glycolic acid, or 40%–50% TCA.^{3,10} The latter is less frequently used on the upper eyelid, however, due to its sensitive nature and the possibility of the peeling agent contacting the eye.¹ Similarly, because deep chemical peels may reach far into the reticular dermis, they are less commonly used when treating the periorbital region due to an increased risk of scarring resulting in lower eyelid ectropion¹²; thus, superficial and medium-depth peels are preferred in periorbital rejuvenation. In general, our LME performs superficial and medium-depth peels.

Microneedling

Microneedling relies on percutaneous dermal microinjury, which reaches the papillary and reticular dermis with minimal disruption to the epidermis.¹³ This stimulates fibroblast proliferation and thus neocollagenesis while avoiding scarring.¹⁴ Moreover, microneedling can be combined with other therapies, such as platelet-rich plasma (PRP) or radiofrequency, to enhance collagen formation.^{15,16} Following treatment, patients experience improvement in pigmentation, rhytides, and scars compared to controls.¹⁶ Microneedling is also performed by our LME.

Lasers, LEDs, and intense/dynamic pulsed light

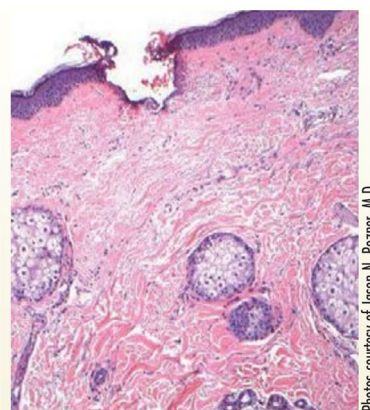
Lasers remain a popular option for resurfacing due to their ability to target particular areas at varying depths depending on the type of laser used. Broadly, lasers can be categorized as ablative or nonablative, but the nonablative options are less commonly used for facial rejuvenation.¹ Ablative lasers include the erbium:YAG (Er:YAG) and CO₂ lasers. Both can minimize periorbital wrinkles and correct hyperpigmentation.¹⁷ The Er:YAG laser wavelength of 2940 nm is readily absorbed by water, which leads to excellent energy absorption by the skin.¹⁸ This

minimizes thermal damage but also the depth of treatment, which limits efficacy in treating deep wrinkles.³ Er:YAG lasers carry a low risk of scarring and relatively quick recovery time, but they also can cause dermal bleeding due to their lack of hemostatic effects. In contrast, CO₂ lasers, with a wavelength of 10,600 nm, are also absorbed by water but penetrate deeper into the dermis.¹⁸ This greater depth of penetration makes CO₂ lasers optimal for skin tightening, but it also confers a greater risk of thermal necrosis or ectropion from excessive skin tightening.³ Both types of lasers have the potential to cause erythema, dyschromia, irritant dermatitis, and scarring.¹⁷

Ablative laser adverse side effects can be mitigated through the use of fractionated lasers. Fractionated laser resurfacing uses either nonablative or ablative lasers and applies them in microscopic columns in an array.¹⁹ This leaves areas of untreated skin between the treated columns, which allows for more rapid re-epithelialization and recovery (Figure 1). Fractionated laser therapies also portend a lower risk of dyspigmentation, which make these options safe for those with higher Fitzpatrick skin types.²⁰ Because smaller areas are treated with each fraction, greater depths of penetration can be achieved, which may allow for enhanced tissue contraction.^{3,19} Thus, this technique can be used in place of chemical peels for the treatment of fine lines and wrinkles, based on surgeon and patient preference. Fractionated laser therapy provides many of the same benefits as traditional lasers such as minimizing photoaging and dyspigmentation, but the fractionated technique may require repeated treatments to accomplish comparable results to traditional lasers. In our practice, the two Er:YAG lasers are shared between the LME and the surgeons. Although deep full-face fractionated laser has been performed in the clinic setting, we have found it difficult to achieve a satisfactory level of comfort for the patient. However, more focalized deep treatments in the periorbital and perioral regions, often at the same time as having a surgical procedure, are well-tolerated.

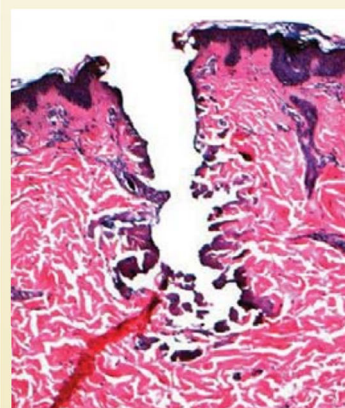
Alternatively, light-emitting diodes (LEDs) provide a noninvasive phototherapy option for those seeking improvement in fine lines and dyspigmentation. Multiple wavelengths of LEDs can be used depending on the therapeutic target, but all have a similar mechanism of action— photobiomodulation.²¹ This, in turn, stimulates fibroblast proliferation, growth factor production, and collagen synthesis. LEDs thus lead to improvement in rhytides and photoaging while maintaining a favorable safety profile.

Photodynamic therapy (PDT) and intense pulsed light (IPL) can also be used in the rejuvenation of the periorbital region. PDT uses the application of 5-aminolevulinic acid (5-ALA) and a light source, which activates the 5-ALA and generates reactive oxygen species. This damages nearby cells and triggers the healing cascade. Patients report decreased signs of photoaging and wrinkles.²² However, 5-ALA causes conjunctival irritation, so care should be taken when using PDT in the periorbital region. IPL (or, as our Er:YAG platforms call this modality, broadband light [BBL]) employs bursts of light from a flashlamp and is particularly useful when targeting photoaging and hyperpigmentation (Figure 2).¹ IPL may also minimize the appearance of wrinkles, but the efficacy of IPL in this context



Photos courtesy of Jason N. Pozner, M.D.

ProFractional Variable Treatment Depth - 150 microns



ProFractional Variable Treatment Depth - 1,000 microns

FIGURE 1 Histology of epidermis and dermis following treatment with fractionated laser resurfacing. Note the areas of untreated skin surrounding the treated columns, which are applied in an array and allow for more rapid recovery.

remains unclear—some studies report better results with fractionated laser therapy over IPL while others did not find a significant difference between the two.^{23,24} We use the BBL modality for the treatment of periorbital scars, and our LME uses it for periorbital skin rejuvenation.

Dermabrasion

Although effective in other regions of the face, dermabrasion and microdermabrasion are infrequently used in the rejuvenation of the periorbital area. Dermabrasion can improve the appearance of facial rhytides and dyschromia, but the delicate nature of the periorbital skin does not lend itself well to treatment with mechanical dermabraders. Consequently, dermabrasion is avoided entirely in the eyelids due to the risk of catastrophic eyelid avulsion. If used, the manual technique, which involves a silicon carbide sandpaper, is

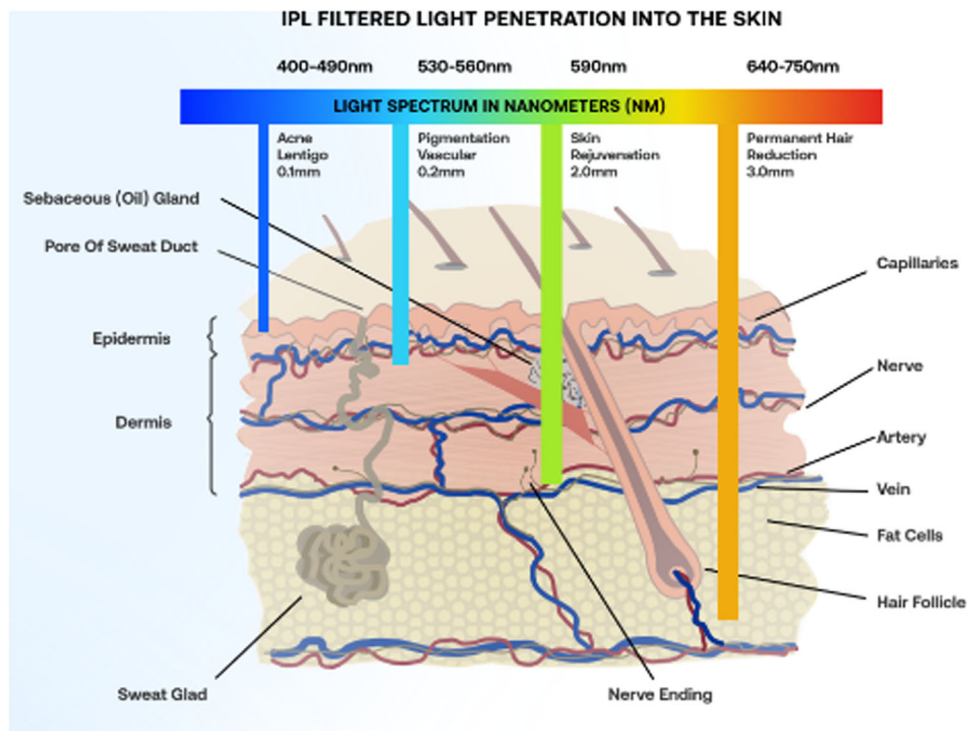


FIGURE 2 Illustration of broadband light (BBL) technology. The choice of light wavelength allows the clinician to target a particular layer of the skin while sparing structures in deeper layers, such as hair follicles. IPL, intense pulsed light.

typically employed as it is safer and allows for more control over the extent and depth of treatment than other methods.^{1,4}

Fillers and injectables

Neuromodulation

The neurotoxins are very common and versatile treatments for periorbital and forehead dynamic wrinkles as well as shaping of the brow. These naturally occurring toxins inhibit acetylcholinesterase release at the neuromuscular junction, reducing muscular contraction and resulting in softening of dynamic wrinkles. Although botulinum toxin's effects are irreversible, they typically wear off by 3–6 months due to regeneration of the axon terminals.²⁵ Botulinum toxin has an excellent safety profile, but its temporary effects require repeated treatments to maintain efficacy. A new neurotoxin, daxibotulinum toxin A (Daxxify), has shown promise in clinical trials and was approved by the Food and Drug Administration in September 2022. In clinical trials, Daxxify demonstrated reduced severity in glabellar lines for a median of 24 weeks compared to placebo, and it was overall well tolerated.^{26–29} Most common side effects included headache, injection site pain, and erythema.²⁹ In periorbital rejuvenation, neuromodulation typically targets the lateral canthal lines (or “crow's feet”), brow elevation and shape, and glabella lines.^{4,25,30} Botulinum toxin may also be used 1–2 weeks before resurfacing to enhance outcomes.³¹

Overtreatment can lead to ptosis of the brow and eyelids, which can be minimized through relatively conservative treatment of these areas.

Fillers

Fillers can be used in isolation to restore volume loss or smooth wrinkles, and they can be employed in combination with other rejuvenation therapies such as neuromodulation. Although other types of fillers, such as calcium hydroxyapatite (CaHA) and poly-L-lactic acid, are available and used elsewhere in the face, their use in the periorbital region is limited.³² A complete discussion of fillers is beyond the scope of this article, but some general concepts will be reviewed.

In periorbital rejuvenation, HA fillers are most commonly used. HA fillers are generally evaluated by elasticity (denoted as G'), which clinically corresponds to the “feel” of the filler.^{33,34} Greater G' HA fillers have greater viscosity and duration of effect. Thus, lower G' is typically used for more superficial indications used to treat fine rhytides and greater G' is employed when a greater volume is desired, such as for cheek volume and to reverse the orbital vector, or when filling beneath the thicker skin of the forehead.^{33,34} Another type of filler, CaHA, is often used by the senior author to restore volume to the malar eminences, creating support for the lower eyelids. CaHA should not be used directly in the tear troughs, however. Low and intermediate HA fillers can be used instead to fill tear-through deformities.³⁵

Other injectables

Other injectables have emerged in facial rejuvenation including PRP. With PRP, blood is drawn from the patient and centrifuged to isolate the platelets and plasma from the blood.³⁶ This material is then injected intradermally and subdermally over multiple treatment sessions. Following PRP therapy, patients report improvement in photoaging, hyperpigmentation, and periocular wrinkles with high patient satisfaction scores.³⁷ Side effects were largely due to the injections themselves, such as injection-site pain and bleeding, and few if any adverse reactions to the material have been reported when used for periorbital rejuvenation.

In-office surgical interventions

Patient selection

When electing to perform surgical interventions in the office, patient selection and comfort are paramount to success. Those patients who may not tolerate general anesthesia or who are seeking less expensive rejuvenation are ideal candidates for procedures in a clinic; surgical interventions performed in the clinic setting are conducted under local anesthesia with only mild sedation. At all patient visits, vital signs including blood pressure and heart rate are documented in an effort to reveal “white coat hypertension” before any procedures. This phenomenon, although seemingly benign, may

signal that the patient would be more anxious and apprehensive about undergoing surgical interventions without general anesthesia causing excessive bleeding and a higher risk for hematoma. If the patient's blood pressure is longitudinally elevated, they should be sent to their primary care provider before their scheduled procedure for further evaluation and consideration of short-term blood pressure medication. Blood pressure should be checked again on the day of the surgery not only to assess the patient's comfort but also to determine whether the patient can tolerate a sedative, such as diazepam, given before the procedure. Most patients experience a decrease in blood pressure after taking 5–10 mg of diazepam, with the first 5 mg taken 30–45 min before arrival in the clinic and a second 5 mg upon arrival to the procedure room.

Special considerations merit further discussion. Patients who drink alcohol daily often require higher doses of diazepam to control their anxiety and may display platelet dysfunction. Patients who do not tolerate contact lenses are often intolerant of corneal shields during eyelid surgery and are poor candidates for ptosis repair using the internal approach.

Patient comfort

To minimize the patient's anxiety on the day of the procedure, as mentioned, the authors recommend prescribing three doses of 5 mg diazepam and clear instructions on how to take them to control procedure-related anxiety and blood pressure. Before bringing the



FIGURE 3 Patient photographs before and after trichophytic brow lift and blepharoplasties performed in the clinic setting. The upper panel depicts the patient preoperatively, and the bottom panels are postoperatively. Note that corrugators were also removed during this procedure, which limits the need for future neuromodulation therapies, and fine hair growth is occurring through her scar.

patient back to the procedure room, everything is prepared—including laying out all instruments necessary for the surgery; the loud clanging of metal instruments is anxiety-provoking. Playing music that is soothing to the patient before the patient enters the procedure room establishes a calm environment in which the procedure will be performed. Before injecting local anesthesia, inform the patient that they will feel a light touch, and before injection, apply pressure to where you will inject so that they know what to expect. A distraction, such as light tapping on the patient's arm or leg by the nurse, is very calming during injection. Allowing 15–20 min for the local to reach maximal effect allows the efficient surgeon time to see another patient before beginning the procedure.

During surgery, use alternative names for surgical instruments that are determined with the team before the procedure, such as referring to a 15-blade as “15” rather than “scalpel” and “double” rather than “double-prong skin hooks,” so that patients do not hear terms that would induce anxiety during the procedure. The team in the procedure room is reminded to remain calm during the procedure at all times. Altogether, these steps minimize patient's apprehension before and during their procedure, which not only improves patient satisfaction but also patient compliance throughout their surgery (Figure 3).

Procedures amenable to a clinical setting

Undeniably, certain procedures lend themselves better to the in-office setting than others. Below is a list of procedures that are regularly performed in the office setting:

1. Upper and lower blepharoplasties.^{2,38}
2. Brow lifts using direct, midforehead, coronal, or trichophytic techniques.^{2,39}
3. Ptosis treatment via anterior and posterior approaches (although posterior proves more challenging).
4. Combination procedures, such as lasers and chemical peels, which are frequently added to blepharoplasties, ptosis repair, and brow lifts.

CONCLUSIONS

Numerous treatment options are available to achieve periorbital rejuvenation in the clinic. Ancillary treatments often delegated to nonsurgical staff include topical cosmeceuticals, chemical peels, lasers, neuromodulators, and fillers. These are used to complement surgical procedures and thereby offer comprehensive periorbital rejuvenation. To successfully offer surgical interventions in the office, surgeons should focus on optimizing patient selection and maximizing patient comfort throughout all stages of the clinic visit. In doing so, surgeons will be able to offer a wide range of surgical procedures for patients in the office setting.

AUTHOR CONTRIBUTIONS

Sarah M. Russel and J. Madison Clark contributed to the conceptualization, study design, data collection and analysis, drafting the manuscript, and manuscript revisions.

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DATA AVAILABILITY STATEMENT

Not applicable.

ETHICS STATEMENT

As this study was a review, IRB approval was not required.

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