Comprehensive Treatment of Periorbital Region with Hyaluronic Acid

[a]BRUNA SOUZA FELIX BRAVO, MD; [b]CAMILA ROOS MARIANO DA ROCHA, MD; [b]JULIEN TOTTI DE BASTOS, MD; [c]PRISCILA MARA CHAVES e SILVA, MD

[a]Cosmiatry Outpatient Clinic of the Hospital Federal da Lagoa, Rio de Janeiro, Brazil; Instituto de Dermatologia Professor Rubem David Azulay da Santa Casa de Misericórdia do Rio de Janeiro, Rio de Janeiro, Brazil; [b]Hospital Federal da Lagoa, Rio de Janeiro, Brazil

ABSTRACT

The periorbital subunit is one of the first facial regions to show signs of aging, primarily due to volume depletion of the soft tissue and bony resorption. Surgical and office-based nonsurgical procedures form an important basis for periorbital rejuvenation. It is important to make a detailed clinical evaluation of the patient to indicate the most appropriate procedure to be performed. With the objective of showing a nonsurgical procedure for the rejuvenation of the periorbital area, the authors describe a technique of applying fillers in the upper and lower periorbital regions, paying attention to the anatomy of this facial region and the type of product to be used besides the expected results of the procedure and its possible adverse effects and complications. The nonsurgical rejuvenation of the periorbicular region with hyaluronic acid is a new and innovative technique. In the opinion of the authors, it is a great aesthetic impact area and consequently brings high satisfaction to patients. (*J Clin Aesthet Dermatol.* 2015;8(6):30–35.)

Maintaining a youthful and pleasant appearance of the face in today's culture impacts quality of life in many patients. The facial contour remodeling is being revolutionized by new nonsurgical techniques.

Facial aging is a complex and dynamic process. All people age differently as a result of imbalance, disharmony, and disproportion of the aging process between the overlying soft tissue and the underlying bony frameworks.[1] The upper periorbital subunit is one of the first facial regions to show signs of aging, and even minor changes in its structure and volume can distort the perceived emotions and health of patients.[2] An aesthetic and youthful upper periorbital subunit is characterized by a well-defined brow of appropriate height and shape, fullness of the upper periorbit, a crisp and well-defined upper eyelid crease, minimal skin excess, and good skin quality.[3,4]

In the aging process of this facial area, one group of patients displays signs of aging due predominantly to soft tissue ptosis of the upper eyelid, requiring surgical excision. Another group presents with volume depletion of the soft tissue and bony resorption of the orbit. The loss of septal support, leading to brow prolapse and an exacerbation of upper eyelid fullness and congestion, can also contribute to the aging process. This appearance is characterized by deflation of the upper eyelid as well as hollowing and visibility of the supraorbital bony rim, leading to a sunken, hollow, and skeletonized orbit, which can make the patient appear sickly, anorexic, and old. In recent years, modern facial rejuvenation surgery has evolved toward volume restoration in addition to tissue suspension.[2]

Comprehensive analysis of both soft tissue and bony structural changes are essential for the periorbital rejuvenation. Surgical procedures and office-based nonsurgical procedures form an important basis for periorbital rejuvenation, including cosmeceuticals, chemical peels, laser and light treatments, neurotoxins, and fillers. Improved understanding of the pathophysiology of aging and technical advancements in nonsurgical techniques has enabled us to achieve better and more comprehensive improvement for patients.[5]

PERIORBITAL ANATOMY (FIGURE 1)

The eyes are probably the most important aesthetic

DISCLOSURE: Bruna Sousa Felix Bravo is a speaker for Allergan. Camila Roos Mariano da Rocha, Julien Totti de Bastos, and Priscila Mara Chaves e Silva report no relevant conflicts of interest.

ADDRESS CORRESPONDENCE TO: Bruna Souza Felix Bravo, MD; E-mail: brunabravo@globo.com

unit in the human body. When the eye region appears bright and fresh, the whole person has an aura of health, vitality, and youthfulness.[6] There is a marked transition from the thin eyelid skin to the thicker skin of the eyebrow and cheek. Eyelid skin is the thinnest in the body, often less than 1mm thick, and unique in having no subcutaneous fat.[7]

The orbicularis oculi muscle, the sphincter muscle of the eyelids, is arbitrarily divided into three portions: pretarsal, preseptal, and orbital. The pretarsal portion of the muscle is thin, overlies the tarsal plates, and is essential for eyelid position and reflexive blinking. Weakening this portion of the muscle will change the eyelid shape and contour. The preseptal portion courses in concentric curves, anterior to the orbital septum. The muscle is involved in involuntary and voluntary eyelid closure. The orbital orbicularis muscle fibers interdigitate with the frontalis and are primarily responsible for forced eyelid closure and depression of the eyebrow.[7]

The blood supply of the eyelids is derived from the facial system, which arises from the external carotid artery, and the orbital system, which originates from the internal carotid artery along branches of the ophthalmic artery. The superficial and deep plexuses of arteries provide a vast blood supply to the upper and lower eyelids. The venous drainage of the eyelids can be divided into two portions: a superficial, or preseptal, system that drains into the internal and external jugular veins, and a deep, or post-tarsal, system that flows into the cavernous sinus.[8,9]

Branches of the ophthalmic and maxillary divisions of the trigeminal nerve provide the sensory innervations of the eyelids. The upper eyelid is innervated by the supraorbital, supratrochlear, and lacrimal nerves. The medial aspect of the upper and lower eyelids is supplied by the infratrochlear nerve. The lateral aspect of the upper eyelid and temple is supplied by the zygomaticotemporal branch of the maxillary nerve. The central aspect of the lower eyelid is supplied by infraorbital nerve, a branch of the maxillary nerve, and the lateral aspect of the lower eyelid is supplied by the zygomaticofacial branch of the maxillary nerve.[10,11] Facial motor function is provided by the facial nerve and the oculomotor nerve. The superior division of the face innervates the upper eyelids via its temporal (frontal) branches and the lower lids via zygomatic and bucal branches.[12]

HYALURONIC ACID

The ideal substance to treat the periorbital region should be biocompatible, nonimmunogenic, stable, and secure, and should offer good cosmetic results, having long-term duration obtained with minimal complication. Of the available fillers, hyaluronic acid (HA) is the one that most approximates all of these characteristics. When used as an injectable filler agent, HA consists of repeating polymer chains of the polysaccharide with internal cross-links of agents that bind the polymer together. By varying the type of cross-linking material and the amount, the characteristics of the gel can vary in the degree of hardness, amount of lift, duration of survival, and resistance of degradation by heat or enzymes.[13] The use of hyaluronic acid with low viscosity, low concentrations. and high malleability is recommended for this area.

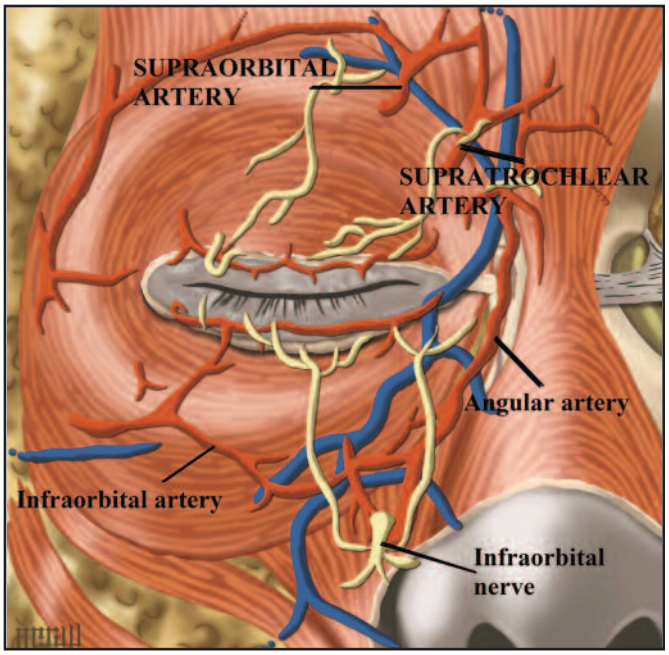

Figure 1. The main branches of the blood supply of the periorbital region

APPLICATION TECHNIQUE

When treating the periorbital region with HA, the authors perform asepsis and antisepsis with three passes of alcoholic chlorhexidine using sterile gloves and gauzes. They mark a point in the hemipupilar line in the upper eyelid crease and a lateral point at the end of the crease (Figure 2). The use of anesthetic lidocaine and an adrenaline button aims vasoconstriction in the area. The anesthetic effect is not necessary because the caliber of the needles and cannulas are extremely small. 27Gx50mm or 30GX 25mm cannulas are used. One orifice is made with a needle of the same gauge of the cannula with an inclination in the direction that will be introduced the cannula with an angle of approximately 45 degrees. In this way, the entire dermis is transfixed, reaching the subcutaneous. The application is made by slow retroinjection. The authors start at the medial point (Figure 3) and close the filling in the lateral point (Figure 4). A small amount of HA with a concentration of 15mg/mL (Juvederme Volbella, Allergan) with high flexibility is used, ranging from 0.1 to 0.2mL per point.

The filling technique for rejuvenation of the lower periorbicular region is held by the authors at deeper levels when compared to the upper region. For this reason, larger volumes of hyaluronic acid are often used. Tracing a point about 2cm below the lower edge of the orbit in intersection

Figure 2. A medial point is marked in the hemipupilar line in the upper eyelid crease and a lateral point is marked at the end of the crease.

Figure 3. The medial point is where the first application is made.

Figure 4. The lateral point is where the last application is made.

with the lateral line of limbo, a micropuncture is made with the needle toward the lower corner of the eye up to the submuscular plane. An angle of approximately 60 degrees is used for the insertion of the cannula below the orbicularis muscle of the eye (Figure 5). One application with the fanning technique is performed until the direction of hemipupillary line. Volumes ranging from 0.3 to 08mL of AH are applied in this region. A fourth point is held at a distance of 1.5cm from the horizontal line from the outer corner of the eye where it meets the malar groove. Strong pressure is applied toward the bone ground at the end of the procedure so that the product can be regularly distributed.

EXPECTED EFFECTS (FIGURE 6)

The reabsorption of the fat pads of the inferior eyelid area or the herniation of them associated with the weakening of the ligaments that support the lower eyelid causes an accentuation of the nasojugal fold and leads to a less smooth transition beetwen the eyelid and the malar region, creating a tired appearance. Filling of the lower eyelid nasojugal fold (tear trough) and palpebral-malar (lateral depression) minimize this aspect and improves the tired appearance that patients often find aesthetically unappealing. The aesthetically attractive lower eyelid should display a relatively smooth transition between the preseptal and orbital portions of the orbicularis oculi

muscle and continue into the upper malar region without a definable transition point.[14]

Filling the upper eyelid has the function of significantly minimizing the emptying and skeletonization of the entire upper periorbital area. Analysis of the upper periorbital region in patients shows that this superior medial bony recession in the aging orbit contributes to the volumetric loss and aged appearance of the upper eyelid. Adding volume to the entire upper periorbit on each side gives a softer and fuller upper periorbit and camouflages the underlying bony rim.[2,15] The curve of the upper edge is restored periorbital, giving a softer, more aesthetically pleasing appearance.

Figure 5. The cannula is inserted below the orbicular muscle of the eye with an angle of approximately 60 degrees.

ADVERSE EFFECTS AND COMPLICATIONS

The most common side effects of the use of HA in the treatment of the periorbital region are bruising, contour irregularities, persistent swelling, and discoloration.[16] Heavy sensation in the eyelid is often cited as a side effect, but patients adapt to this symptom. A certain amount of swelling and bruising is expected and usually lasts no more than a few days.[17] It is recommended that this procedure be performed with good lighting in order to avoid puncturing vessels. In the case of a hematoma, immediate local compression should be performed. Hematomas are usually self-limiting and tend to improve in the range of 5 to 10 days. Using a 30-gauge rather than a 27-gauge needle if possible may reduce the skin trauma. The swelling and bruising can be minimized by applying firm pressure and ice packs before and after a treatment session. Use of unnecessary anticoagulant medications or products, if any, should be stopped.[7] Patients with intense edema may benefit from prednisone treatment over a period of a few days.

Injections applied too superficially can lead to small nodule formation or bluish discoloration under the skin.[17] This bluish discoloration is due to the Tyndall effect, where the blue light spectrum is scattered by the colloid particles more strongly. Nodules can be treated with local massage, aspiration, or incision and drainage of the product. Hyaluronidase can be used to dissolve a nodule or overcorrection and solve this unwanted effect within a few hours.[18]

Granulomatous foreign body reaction can be developed months to years after the injection, but is very rare. This reaction may be asymptomatic or have associated erythema and swelling. Persistent granulomatous foreign body reactions can be treated with intralesional corticosteroid injections. Some authors have advocated the use of hyaluronidase hoping that the breakdown of the product would stop the foreign body reaction.[19]

Recently, there has been discussion on the role of biofilms in causing delayed nodule formation. Biofilms are accumulations of micro-organisms within a self-developed matrix, which are irreversibly adherent to one another and to a variety of surfaces.[19] Some authors propose a two-week window during which bacterial contamination can occur and lead to biofilm formation.[13] Because their growth rate is slow, biofilms usually are not identifiable by culture. Infections resulting from biofilms are notoriously difficult to treat because of their slow bacterial metabolism and their secretion of a protective matrix. Filler injections should not be performed if there is an adjacent site of infection[19] and asepsis and antisepsis should be made exhaustively before the procedure. Hyaluronidase has been shown to help break down the matrix, thereby decreasing the biofilm mass. With respect to antimicrobials, two-drug therapy with a quinolone and third-generation macrolide has been recommended.[19]

The occlusion of blood flow can be due to trauma to the vessel wall, inadvertent intravascular injection of the product, or a direct pressure effect of the filling agent on the vessel causing obstruction of the vessel lumen.[20] Arterial compromise is typically heralded by immediate-onset blanching and severe pain. If recognized during the treatment session, the injection should immediately be stopped and an attempt should be made to aspirate the product. If prolonged blanching and pain occurs while injecting the filler, there is a possibility that cutaneous arteriolar occlusion has occurred. The immediate administration of heat, massage of the area, and application

Figure 6. Patient before and after hyaluronic acid treatment of the periorbital region

of nitroglycerin paste should be performed. If a hyaluronic acid-based filler was used, hyaluronidase can be injected in the blanched, painful area and around the vessels involved in order to disrupt the product and decompress the vessel in the hypoxic area.[17]

Although extremely rare, blindness may be an under-reported complication. According to Coleman,[21] blindness occurs due to migration of a filler embolus in a retrograde manner via an arteriole to an antegrade flow through the central retinal artery. Hence, it is important to limit the amount of filler bolus injected in one site. One way to do this is to use blunt cannulas. The possibility of blindness also can be minimized by moving the needle tip and by injecting slowly, with minimal pressure and minute quantities of the filler at a time.[18]

Injected filler material is presumed to access the ophthalmic artery retrogradely via the supratrochlear, supraorbital, or dorsal nasal artery. Ophthalmic artery occlusion (OAO) is likely caused by complete proximal ophthalmic artery obstruction by a large filler bolus that migrated backward from the high injection pressure. It may also be that small particles migrated back to the central retinal artery and posterior ciliary artery origins and dispersed anterogradely into each branch as injection pressure decreased. This would cause a diffuse obstruction. Possible obstruction points responsible for various clinical features are shown. The rate of ophthalmic complications following cosmetic facial filler injections seems extremely low, especially with HA. However, to decrease the risk of intravascular injection, many physicians suggest slow injection with low pressure of a small fractionated dose instead of a bolus injection as well as the use of a blunt cannula, particularly with the injection of larger volumes.[22]

CONCLUSION

The nonsurgical rejuvenation of the periorbicular region with HA applied with cannulas is a new and innovative treatment technique. In the authors' opinion, it is a great aesthetic impact area and consequently brings high satisfaction to the patients. Proper training, anatomic knowledge, and correct choice of material are essential to the success of this procedure. The authors recommend anyone performing this procedure have some experience in other areas of the face and the ability to use cannulas in the application of HA in this region. The most frequently observed undesirable effect is overcorrection (bumps) or superficial application of the product (Tyndall effect). Fortunately, these are readily resolved with local injection of hyaluronidase.

REFERENCES

1. Kahn D, Shaw R. Aging of the bony orbit: a three dimensional computed tomographic study. *Aesthetic Surg J.* 2008;28:258–264.
2. Liew S, Nguyen DQ. Nonsurgical volumetric upper periorbital rejuvenation: a plastic surgeon's perspective. *Aesth Plast Surg.* 2011;35:319–325.
3. Fagien S. Advanced rejuvenative upper blepharoplasty enhancing aesthetics of the upper periorbita. *Plast Reconstr Surg.* 2002;110:278–291.
4. Kranedonk S, Obagi S. Autologous fat transfer for periorbital rejuvenation: indications, technique, and complications. *Dermatol Surg.* 2007;35:572–578.
5. Moran ML. Office-based periorbital rejuvenation. *Facial Plast Surg.* 2013;29:58–63.
6. Carraway JH. Reconstruction of the eyelids and correction of ptosis of the eyelid. In: Aston SJ, Beasley RW, Thorne CHM, eds. *Grabb and Smith's Plastic Surgery.* 5th ed. Philadelphia: Lippincott-Raven Publishers; 1997:529–544.
7. Hoening J, Hoening D. Minimally invasive periorbital rejuvenation. *Facial Plast Surg.* 2013;29:295–309.
8. Bentsianov B, Blitzer A. Facial anatomy. *Clin Dermatol.* 2004;22:3–13.
9. The Eye MD Association. *Orbit and Ocular Adnexa. Fundamentals and Principles of Ophthalmology.* Singapore: Lifelong Education for the Ophyhalmologist; 2007–2008:5–41.
10. Shams PN, Ortiz-Peréz S, Joshi N. Clinical anatomy of the periocular region. *Facial Plast Surg.* 2013;29:255–263.
11. Palermo EC. Anatomy of the periorbital region. *Surg Cosmet Dermatol.* 2013;5:245–256.
12. Tan KS, Oh SR, Priel A, et al. Surgical anatomy of the forehead, eyelids, and midface for the aesthetic surgeon. In: Massry GG, Murphy MR, Azizzadeh B, eds. *Master Techniques in Blepharoplasty and Periorbital Rejuvenation.* New York: Springer; 2011:11:24.
13. Luebberding S, Alexiades-Armenakas M. Safety of dermal fillers. *J Drugs Dermatol.* 2012;11:1053–1058.
14. Glaser DA, Patel U. Enhancing the eyes: use of minimally invasive techniques for periorbital rejuvenation. *J Drugs Dermatol.* 2010;9:S118–283.
15. Shetty R. Under eye infraorbital injection technique: the best value in facial rejuvenation. *J Cosmet Dermatol.* 2014;13:79–84.
16. Goldberg RA, Fiaschetti D. Filling the periorbital hollows with hyaluronic acid gel: initial experience with 244 injections. *Ophthal Plast Reconstr Surg.* 2006;22:335–341; discussion 341–343.
17. Lafaille P, Benedetto A. Fillers: contraindications, side effects and precautions. *J Cutan Aesthet Surg.* 2010;3:16–19.
18. Sharad J. Dermal fillers for treatment of tear trough deformity: Treatment of anatomy, treatment techniques and their outcome. *J Cutan Aesthet Surg.* 2012;5:229–238.
19. Ozturk CN, Li Y, Tung R, et al. Complications following injection of soft tissue fillers. *Aesth Surg J.* 2013;33:862–877.
20. Daines SM, Williams EF III. Complications associated with injectable soft-tissue fillers: a 5-year retrospective review. *JAMA Facial Plast Surg.* 2013;15:226–231.
21. Coleman SR. Avoidance of arterial occlusion from injection of soft tissue fillers. *Aesthet Surg J.* 2002;22:555–557.
22. Park KH. Iatrogenic occlusion of the ophthalmic artery after cosmetic facial filler injections: a national survey by the Korean Retina Society. *JAMA Ophthalmol.* 2014;132:714–723.