Eyelid Malposition Repair: A Review of the Literature and Current Techniques

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Abstract

Keywords

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- retraction
- blepharoptosis

Eyelid malposition is a challenging problem faced by surgeons. Given the delicate nature of the eyelid and its complex anatomy, eyelid repair requires both a comprehensive understanding of eyelid anatomy along with thorough presurgical planning and surgical execution. A wide range of options is available for eyelid reconstruction but the location and extent of the deformity often dictate the type of repair. This article is a review of commonly encountered forms of eyelid malposition. Relevant reconstructive techniques and current evidence-based methods of reconstruction are discussed in detail. Anatomical considerations, the nature of specific defects, pearls of preoperative evaluation, and the reconstructive options available to the facial plastic and oculo-plastic surgeon are outlined. Topics discussed include ectropion, entropion, eyelid retraction, and blepharoptosis.

Defects of the eyelid pose a unique challenge to surgeons due to the delicate nature of both its form and function. The eyelid skin itself is the thinnest found in the human body due primarily to its decreased dermis relative to other areas of the body. Eyelid defects themselves are most commonly caused by trauma or iatrogenic injury, including ablative surgery for malignancies. The resultant defect can range from the loss of a small portion of superficial tissue to the complete absence of a lid. Repair can also be complicated by a patient's underlying medical comorbidities. A history of previous exposures, such as radiation therapy, can result in full-thickness scarring. General reconstructive considerations should also include the fact that certain patient factors, such as a history of radiation therapy, can not only cause damage to the skin, but also create a situation in which the skin will not accept free grafts, either from autologous skin or other substances.

Upper Eyelid Anatomy

The upper eyelid is a complex anatomical subunit, consisting of a delicate conglomeration of muscles, nerves, and liga-

ments that all have unique and invaluable functions. The superior lid fold is created by tendons from the levator palpebrae superioris, which is the primary elevator muscle for the upper eyelid. The tarsal plate consists of thick fibrous tissue, which is approximately 1 to 1.5 mm thick, and approximately 25 mm in length. The vertical height of the superior tarsal plate is approximately 8 to 12 mm. The tarsal plate contributes to the overall shape, mobility, and strength of the eyelid. Together with the conjunctiva, the tarsus forms the posterior lamella of the eyelid, with the anterior lamella being the skin and orbicularis oculi muscle. The tarsal plates taper both medially and laterally to form the canthal ligaments. The upper tarsus also contains meibomian glands, the sebaceous glands that secrete the oil component of the tear film—helping to lubricate the eye (►Fig. 1).

The eyelid margin divides the upper eyelid into a medial lacrimal and a lateral ciliary portion. The lacrimal portion extends from the punctum to the medial canthus. However, the ciliary portion is unique in that it contains modified sebaceous glands and approximately 100 to 150 cilia along the intermarginal strip. These modified sebaceous glands

Fig. 1 Upper eyelid anatomy.

include the glands of Zeis located along the hair follicles of lashes and the glands of Moll located between the lashes, which open directly along the lid margin. The upper eyelid also characteristically contains two fat compartments labeled medial and central. The lateral compartment of the upper lid is composed of the lacrimal gland. The upper eyelid fat pads are separated by fascia extending from Whitnall's ligament. This ligament helps to suspend the globe and acts as a fulcrum for the action of the levator.¹

The muscular layer of the upper eyelid is composed of the lid retractors, which are responsible for opening the eyelids. The lid retractors are made up of both striated and smooth muscle components. In the upper lid this is known as the levator complex, while in the lower lid it is known as the capsulopalpebral fascia (CPF). The upper lid retractors include the levator palpebrae and Müller's muscle. The levator palpebrae, innervated by the oculomotor nerve, inserts into the tarsal plate and serves as the primary elevator of the upper eyelid. Müller's muscle lies deep into the levator. It consists of smooth muscle and is innervated by the sympathetic nervous system. It inserts into the superior

margin of the tarsus. It is expected to see approximately 2 mm of ptosis when interruption to the sympathetic innervation occurs, as is seen in Horner's syndrome.¹

Lower Eyelid Anatomy

As described briefly above with reference to the upper eyelid, the lower eyelid is divided into the anterior, middle, and posterior lamellae. The anterior lamella is composed of the skin and the orbicularis oculi muscle. The skin found in the anterior lamella is the thinnest skin in the body, and has little to no subcutaneous fat between it and the muscle. The middle lamella is also known as the orbital septum, and acts as a supportive barrier between the anterior and posterior lamellae. The tarsus, lower lid retractor, and palpebral conjunctiva create the posterior lamella. The inferior tarsal plate has a shorter vertical height than the upper, and is usually approximately 3 to 5 mm. As in the upper lid, rows of meibomian glands are aligned across the tarsal plate to aid in the lubrication of the eye (→Fig. 2).

The muscles responsible for retracting the lower eyelid are analogous to those in the upper lid. The levator aponeurosis corresponds to the CPF and the inferior tarsal muscle corresponds to Müller's muscle. The CPF surrounds the inferior oblique muscle, and continues to reconnect and form the inferior transverse ligament or Lockwood's ligament.¹ Lockwood's ligament is comparable to Whitnall's ligament in the upper eyelid. The inferior tarsal muscle originates posteriorly on the CPF.

Similar to the upper eyelid, the lower eyelid also contains fat pads or fat compartments. As opposed to the two fat pads found in the upper lid, the lower eyelid contains a medial, central, and lateral fat pad. The medial and central components are separated by the inferior oblique muscle. Eisler's fat pad is an additional accessory fat pad located in Eisler's pocket, and is a good landmark for the level just superior to Whitnall's tubercle.² It is crucial for the surgeon to have a detailed understanding of these anatomical subunits, as they can all contribute in unique ways to the positioning of the lower eyelid.³

Fig. 2 Lower eyelid anatomy.

Preoperative Evaluation

There are several important general tenets to the preoperative evaluation of a patient with eyelid malposition. As with all surgical procedures, particularly cosmetic procedures, patient selection and managing patient expectations are of the utmost importance. The patient should be medically and psychologically prepared to undergo both the procedure and the recovery. A thorough medical and surgical history must be taken, particularly if there is a history of thyroid disease, myasthenia gravis, or any bleeding disorder. A history of previous ocular pathologies, such as dry eye syndrome, glaucoma, or other inflammatory eye disease, must be documented. It is important to be aware of patients with a history of refractive surgery (e.g., laser-assisted in situ keratomileusis; LASIK), as these individuals are more prone to dry eye syndrome.⁴ Surgeons must be aware of a history of previous facial trauma, any surgeries, or use of neuromodulators or soft tissue fillers.⁴ The physician must obtain a list of all medications, both prescription and over-the-counter or herbal supplements.^{1,3}

In addition to a thorough history, a detailed examination of both the orbits and the face as a whole must be performed. Eyelid examination should always include careful inspection of the lids, lashes, conjunctiva, and cornea. Orbital muscle function, including the levator palpebrae, must be recorded, as well as the presence or absence of Bell's phenomenon. A positive Bell's phenomenon is a good prognostic factor, as it both implies that a patient is protecting his or her cornea in the case of preoperative lagophthalmos and also that they can tolerate some degree of postoperative lagophthalmos.¹

Upper eyelid evaluation should commence with analysis of the eyelid margin. The presence of ptosis is diagnosed when the lid margin sits more than 1 mm below the upper limbus. While severe ptosis, with a lid margin 4 mm or more below the upper limbus, is usually obvious, mild ptosis can be easily missed. True ptosis must be distinguished from pseudoptosis, usually caused by a descended brow. Careful examination of the skin may reveal underlying conditions that may require further management. The extent of dermatochalasis, if present, must be documented. Upper lid laxity must be assessed, as well as orbital volume. Lower eyelid evaluation includes exploring the shape and position of the lid margin, the supporting ligaments, and the interface with the cheek. Canthal ligaments might be lax, leading to rounding and scleral show. Canthal ligament strength is interrogated with gentle distraction, sometimes called the "snap-back test." Excessive lid distraction and slow recoil suggest canthal ligament laxity.

In addition to the lids, the association of the globe to the orbital rim, orbital fat, and cheek should be examined. This relationship can be described as either a positive or a negative vector. A positive vector orbit shows the inferior orbital rim in a position anterior to the globe. A negative vector orbit refers to an inferior orbital rim that appears retruded relative to the cornea. This type of orbit is associated with proptosis, orbital fat herniation, and deep nasojugal grooves.⁴⁻⁶

As a general tenet for all functional and cosmetic patients, preoperative and postoperative photographs must be documented. Informed consent must include an honest discussion of complications and the possibility of the need for revision. Postoperative care should also be reviewed. As alluded to earlier, it is vital to determine and set realistic goals with the patient.⁴

Entropion

Entropion, defined as inward rotation of the eyelid margin, is one of the most commonly seen eyelid malposition defects encountered by oculoplastic surgeons. Patients generally present with significant corneal irritation due to contact with eyelid epithelium, as well as the eyelashes. Therefore, the primary complaint of a patient suffering with entropion will be related to discomfort, including redness, tearing, and foreign body sensation. Entropion can be congenital, spastic, involutional, or cicatricial in nature. The underlying etiology of entropion is important in preoperative evaluation and efficacious surgical repair. In addition to inspection of the eyelids, lashes, conjunctiva, and cornea, eyelid examination should include assessment of the canthal tendons and lower lid laxity. Lower lid excursion with downward gaze should be evaluated, as it may reveal lower lid retractor weakness. Normal downward displacement of the lower lid is approximately 4 mm. The depth of the inferior cul-de-sac should be evaluated. If it is suspected that the entropion is cicatricial in nature, shortening of the posterior lamella should be evident.⁷

Congenital Entropion

Congenital entropion, a rare entity, is characterized by inward rotation of the entire lid margin. The underlying etiology is thought to be overactive movement of the orbicularis muscle combined with an abnormality in the insertion of the lower eyelid retractors in which they are disinserted. It is frequently associated with a fold of lower eyelid skin that pushes the eyelashes against the globe itself—a condition known as epiblepharon. Surgically, congenital entropion can be repaired by resuspending the CPF. If epiblepharon is present, making a horizontal incision across the lower eyelid, approximately 1.5 mm inferior to the lash line, can repair it. A small amount of pretarsal orbicularis muscle is removed, exposing the inferior tarsal border. Wound closure is accomplished by approximating the upper skin edge to the inferior tarsal border and the lower skin edge.⁷

Acute spastic entropion generally occurs following ocular surgery, trauma, or inflammation. While it is possible for this condition to improve with resolution of the underlying edema and blepharospasm, it can also result in a situation in which the spastic entropion leads to more irritation and further spasm. Initial treatment typically involves injection of botulinum toxin to the orbicularis muscle, breaking the blepharospasm. Entropion may resolve on its own by the time in which the botulinum effect dissipates, generally at around 3 months. Frequently, there is also an involutional component to the spastic entropion that will eventually reveal itself.⁷

Involitional Entropion

Involitional entropion is the most commonly encountered form of entropion. There are several different mechanisms at play in the pathophysiology of this problem. Laxity in the medial and lateral canthal tendons, combined with tarsal thinning associated with aging, results in diminished horizontal support of the lower lid. The decision-making process for surgical repair involves understanding of the type and severity of the malposition, in addition to patient factors including their medical comorbidities and capacity to tolerate a procedure.⁸

Standard surgical repair of involitional entropion involves correction of the causative factors, and typically employs a tarsal strip procedure in addition to reattaching the CPF.^{9,10} Given the versatility and effectiveness of the lateral tarsal strip in eyelid malposition surgery, we will briefly review the procedure here (►Fig. 3). Injection of local anesthesia is followed by a subciliary incision approximately 2 mm below the lash line from below the punctum to the lateral canthal angle. Dissection of a small skin flap is taken inferiorly over the

tarsus, and a strip of pretarsal orbicularis muscle is dissected off of the tarsus. The orbital septum is then tented and incised, exposing the edge of the CPF, recognized by its thin, white appearance. This fascia, which lies below the inferior orbital fat pad, is the lower eyelid counterpart of the superior eyelid's levator. This fascia is frequently marked with a 4-0 silk suture for easy identification. Next, a lateral tarsal strip is performed to address lower eyelid laxity. The tarsal strip is sutured to the lateral orbital rim, with careful attention to the amount of tension placed on the eyelid. The CPF is then reattached to the inferior tarsal border using three or more sutures. Having the patient awake enough to perform a downward gaze can be helpful in confirming the appropriate amount of correction (►Fig. 4). As previously mentioned, lower eyelid excursion is normally approximately 3 to 4 mm. The skin is then closed, with a small amount of the CPF edge incorporated into the three central sutures to form a barrier preventing the orbicularis muscle from overriding. Suture is then used to recreate the lateral canthal angle.^{3,6,11}

Fig. 3 (A–E) Lateral tarsal strip procedure.

Fig. 4 (A–E) Capsulopalpebral fascia repair.

There are many current case series discussing new surgical repair techniques to address involutional entropion, several of which combine new techniques with more traditional ones. For example, the Quickert rotational suture is a classic method of mechanically tightening the lower lid retractors, and obviates the need for a skin incision. However, when used alone, this technique results in a high recurrence rate and fails to address horizontal lid laxity.^{12,13} Another method, called the modified Bick quick strip, described by Barrett and Meyer in 2012, reported excellent long-term outcomes.¹⁴ A new retrospective case series by Golan and Lelli in 2018 described combining these two techniques, and reported a high success rate with no long-term complications.¹⁵ Similarly, Baek et al reported a reduced recurrent rate with the Quickert suture plus the lateral canthal strip when compared to the Quickert suture alone.¹⁶

Cicatricial Entropion

Cicatricial entropion has a wide range of causes, including trauma, burns, chronic medication use, and infection. Surgical repair is commonly achieved with the Wies procedure, which involves a transverse blepharotomy and marginal rotation of the affected eyelid.^{17,18} After administration of local anesthesia, a horizontal incision is made 4 mm inferior to the lid margin through the skin and orbicularis muscle, taking great care to spare the marginal arcade. A second incision is made through the conjunctiva and tarsus with the lid everted. Either Westcott or tenotomy scissors are used to

extend the full-thickness blepharotomy medially and laterally across the tarsus. Sutures are then passed through the tarsus internally and over the surface of the tarsus, exiting the skin near the lash line, in a mattress fashion. Rotation is increased by passing the sutures closer to the lash line.⁷ In the case of severe cicatricial entropion, or in the case of failure of the Wies procedure, it may be necessary to augment the posterior lamella. This can be achieved with a graft placed between the conjunctiva and lower lid retractor complex and the inferior tarsal border of the lower lid. Grafts can be made from various mediums, including auricular cartilage, nasal septum, and mucous membrane. Posterior lamellar grafting may result in less optimal lid retraction with downgaze.^{17,19}

Several novel techniques for repair of cicatricial entropion have been proposed, including a recently published report of using labial mucous membrane as a posterior lamellar graft. The authors report data from a 16-year period, and quoted a 98% improvement in ocular symptoms, an 83% rate of complete restoration of normal upper eyelid position, and an 11% recurrence rate.²⁰ Additionally, in line with the overwhelming trend towards minimally invasive surgery over the last decade, a grey-line-incision-only approach to anterior lamella repositioning has been proposed. This technique avoids the classic skin-crease or conjunctival incisions, and reported a 100% success rate in achieving a normal lid margin, and 72% of patients reporting symptomatic improvement.²¹

Ectropion

Ectropion is another common form of eyelid malposition, and is simply defined as a turning out of the eyelid margin. Similarly to entropion, several different pathological processes may cause ectropion. The types of ectropion can be broken down into the categories of involutional, cicatricial, paralytic, and mechanical. These are managed in unique ways, and as such will be reviewed separately. However, the initial evaluation and clinical examination should be similar for all cases of ectropion. Lower eyelid laxity should be measured, and can be established by gently pinching the lower eyelid skin and pulling straight out from the vertical plane of the globe. The intervening distance is defined as the lower eyelid laxity. Canthal tendon laxity should also be measured, and is done by pulling the lid medially and laterally. If the lateral tendon is lax, the horizontal palpebral width should decrease with stretch. Medical canthal tendon laxity is present if punctual displacement across the nasal limbus occurs with tension. Finally, with pushing the lid superiorly, the eyelid margin should cross 2 to 3 mm above the inferior limbus while in primary gaze. Gladstone et al astutely described these three maneuvers as “the three P’s: pinching, pulling, and pushing,” and all three should be performed in evaluating every patient with ectropion.⁷ The MRD2 (marginal reflex distance), or distance of the corneal light reflex to the lower eyelid margin, and amount of inferior scleral show should also be documented.

Involutional Ectropion

Involutional ectropion, the most frequently encountered type, is caused by age-related lower eyelid laxity. This laxity is a result of a combination of gravity and atrophy of the orbicularis muscle and medial and lateral canthal tendons. The condition makes it difficult for the eyelid to conform to the contour of the globe, as the tarsal plate undergoes an imbalance of forces. The resultant corneal and conjunctival exposure leads to irritation and inflammation. Excessive tearing, or epiphora, another sequelae of ectropion, results from loss of muscle tone and eyelid malposition. These symptoms predispose the patient to eye rubbing, which can further exacerbate the process.

The most important considerations in choosing a surgical repair are the severity of the dysfunction and the degree of medical canthal tendon laxity. Plication of the lateral canthal tendon alone, or canthopexy, can be effective in mild cases without associated medical canthal tendon laxity. However, for more severe cases of ectropion without medial canthal tendon laxity, a lateral tarsal strip is more appropriate. The lateral tarsal strip, first described by Anderson and Gordy in 1979, involves a lateral canthotomy, followed by transection of the lateral canthal tendon. A tarsal strip is fashioned from the posterior lamella, and then sutured to the periosteum of the lateral orbital wall, thereby correcting the height and tension of the lateral canthus.^{22,23}

If medical canthal tendon laxity is significant, it must be addressed to prevent displacing punctum laterally with the above maneuvers. This can be accomplished with medial

canthal tendon plication. In the case where punctual ectropion exists in the presence of a normal medial canthal tendon, a small elliptical incision to shorten the posterior lamella can be reparative. While these procedures are able to solve most cases of ectropion, more severe or refractory cases may necessitate more extensive surgeries, including temporalis muscle transfer.

An interesting, recently published case study reports using hyaluronic acid injection to correct for involutional and cicatricial ectropion, which will be discussed in greater detail below. In this case report, the patient suffering from involutional lower eyelid ectropion was treated with a subcutaneous injection of hyaluronic acid below the ciliary margin above the plane of the orbicularis oculi both laterally and medially. The authors report patient satisfaction with both cosmesis and function. However, by the nature of hyaluronic acid, these results are temporary. Despite this fact, the authors propose that by way of inducing fibroblasts to produce collagen, some long-term effect may be generated.²⁴

Paralytic Ectropion

Paralysis of the orbicularis muscle results in the next type of ectropion known as paralytic ectropion. Common etiologies include trauma, Bell's palsy, surgery, and stroke. With permanent paralysis, the chance of ectropion development increases dramatically. Initially, conservative measures must be taken to protect the cornea, such as aggressive lubrication and physical protection with moisture chambers or “bubbles.” While helpful in the immediate period, these options are suboptimal for long-term management. The lateral tarsal strip, as described above, is an effectual method of repair in the case of paralytic ectropion. In more severe cases, additional tarsorrhaphy can be employed.

The tarsoconjunctival flap is another method of repair, and can be performed in condition with the lateral tarsal strip. Sufyan et al described this technique for paralytic lower eyelid ectropion, with Tao et al reporting improved eyelid closure via this technique in a series of 110 patients.^{25,26} One of the first studies to report quality-of-life outcomes after repair of paralytic ectropion was recently published by Dedhia et al, reporting that lateral tarsal strip canthoplasty with the tarsoconjunctival flap resulted in both improved lower eyelid position and patient quality of life. Such studies are important to recognize, as quality-of-life outcomes are becoming increasingly critical.²⁷

Cicatricial Ectropion

Cicatricial ectropion, or ectropion secondary to scarring, is often a result of anterior lamella shortening. Traumatic scarring is frequently irregular, resulting in partial or complete ectropion. Conversely, scarring that occurs as a result of dermatologic conditions can be more diffuse in nature, and is more likely to be associated with bilateral ectropion. Regardless of the underlying cause, repair must center on addressing the anterior lamellar insufficiency. The procedure of choice is generally full-thickness skin grafting, but z-plasty sometimes has a role if scarring and ectropion are minimal.

Surgical management involves excision of scar tissue and lysis of anterior lamellar scar bands. Once scarring is excised, the remaining anterior lamellar defect is approximated by using a template, frequently composed of a piece of Telfa gauze. Full-thickness skin grafts can be obtained from a variety of places, but some tend to heal better than others. For example, upper eyelid skin is optimal for upper lid grafts, while retroauricular skin tends to work better for lower eyelid and medial canthal grafts (→Fig. 5). Great care must be taken to ensure that sufficient skin will remain when choosing an upper lid graft.

As discussed above in the section on involutional ectropion, hyaluronic acid injection is a new area of interest in ectropion repair, and several case series have discussed its use in the treatment of cicatricial ectropion. The proposed mechanism is that the filler expands the anterior lamella, which is tethered in cases of cicatricial ectropion. While some series report success, a series of 11 patients described by Romero et al reported a poor cosmetic result, and suggested the filler only be used in patients who are poor surgical candidates or who refuse surgery.^{28,29}

Postradiation cicatricial ectropion is a subclass of cicatricial ectropion that is encountered frequently in the head and neck cancer population. Radiotherapy poses a significant problem for facial plastic surgeons, as it causes contraction of soft tissues, shrinking of the anterior lamella, and both

skin and muscle dystrophy.³⁰ There have been many suggested techniques for repairing postradiation ectropion, and these generally involve multiple approaches. A canthoplasty, frequently with tarsal strip, is typically employed, with the addition of a placement of a graft or flap to address the anterior, middle, and/or posterior lamella. Full thickness skin grafts have shown success in many case series and reports in the literature. Kim et al, a case series of 25 patients with postradiation cicatricial ectropion, showed great success utilizing full-thickness skin grafts. The majority of patients in that study reported improved ocular symptoms and reduced use of topical lubricants.^{30,31}

Mechanical Ectropion

Finally, mechanical ectropion occurs secondarily to an eyelid mass or tumor. The mass must be removed, and upon removal a residual involutional ectropion may ensue. It is sometimes possible to treat both conditions simultaneously by employing a pentagonal wedge resection of the mass. However, when unsuccessful, additional lid tightening procedures may be necessary. An interesting new technique for repair of such defects—the myotarsal flap—was described in a study published by Mehta. This retrospective case series of 163 patients demonstrated both aesthetic and functional success of this flap, used in conjunction with quilted skin grafts.³²

Fig. 5 (A–C) Cicatricial ectropion repair with skin graft.

Retraction

Eyelid retraction, which most commonly affects the lower eyelid, is a commonly encountered and multifactorial condition. Causes include scarring from trauma or surgery, thyroid ophthalmopathy, unilateral ptosis with resultant contralateral overactivity of the levator palpebrae muscle, Parinaud's syndrome, and chronic corticosteroid use. The most common cause seen in clinical practice is thyroid ophthalmopathy, or Graves' disease. There are multiple factors associated with thyroid ophthalmopathy that cause eyelid retraction, including proptosis of the globe, adhesion between the levator muscle and the orbital septum, excessive levator muscle activity, and increased Müller's muscle contraction. As with all causes of eyelid malposition, preoperative evaluation is crucial. Clinically, there will be increased scleral show, resulting in rounded eyes, and lateral canthal tendon laxity.⁹ The MRD1 (marginal reflex distance) or the distance between the center of the pupillary light reflex to the upper eyelid margin should be measured, with the normal distance being approximately 4 to 5 mm. The cornea must be inspected carefully for evidence of exposure keratopathy. The surgeon may consider obtaining a computed tomography (CT) scan without contrast to allow visualization of the extraocular muscle size and rule out other orbital pathologies.

While conservative treatments, such as aggressive lubrication with artificial tears, are adequate for some, most patients eventually require surgical intervention either for exposure keratopathy or aesthetic concerns. An increasing number of individuals are interested in cosmetic repair, frequently due to excess inferior scleral show. Lower eyelid retraction can be approached with either a grafting or a nongrafting method. The degree of retraction generally dictates which surgical technique is chosen. For mild cases of lower eyelid retraction, procedures such as lower eyelid retraction recession and the lateral tarsal strip, which correct both the vertical traction and the horizontal laxity respectively, are commonly used. For cases of more severe retraction, spacer grafts are employed to elevate the lower eyelid margin. Spacer grafts can be in the form of autografts, such as auricular cartilage or hard palate mucosa, allografts such as alloderm, or various synthetic materials.^{31,33}

Novel methods of repair described include vertical midface lifting with periorbital anchoring, which was supported by a retrospective case series of 199 patients over the course of 10 years published by Pascali et al. In this study, causes of eyelid retraction included cosmetic blepharoplasty, involutional ectropion, tumor resection, facial nerve paralysis, and trauma. In this study, 98% of patients experienced objective improvement in eyelid retraction and improvement on both function and aesthetics.³⁴ Similarly, Le Louarn published the results of a retrospective case series of 342 patients who underwent concentric malar lift for the management of lower eyelid retraction. Like the study by Pascali, he reported that all cases of lower eyelid retraction experienced significant improvement in function and aesthetics. Both authors felt the positive results of their series were due to their procedures' abilities to recruit a significant amount of skin into the lower eyelid.^{34,35}

Blepharoptosis

Blepharoptosis is a term used to describe drooping of the upper eyelid. There exists some debate in the literature as to how exactly to define blepharoptosis, as it can be described in both subjective and objective terms. An MRD1 of 4 mm is generally considered normal, but it is challenging to present an exact cutoff for ptosis given the variations seen between races.^{36,37} Ptosis can also be defined functionally, for example if the eyelid is low enough to obstruct the visual field. In order to appropriately correct ptosis, the surgeon must correctly identify the etiology. Discerning the underlying cause can pose a challenge, as ptosis can represent a wide range of illnesses in addition to a solely cosmetic issue. The surgeon must take a thorough history of both the patient's general health as well as the ptosis itself, including the timing of onset, duration, and severity. The presence of concomitant symptoms must also be uncovered, such as any vision changes or loss, changes in sensation, or other cranial nerve deficits.³⁷ Additionally, evaluating clinicians must always take into consideration whether or not they are seeing a true ptosis or one that is secondary to retraction of the contralateral upper eyelid. In general, blepharoptosis can be broken down into the broad categories of congenital and acquired. The causes of acquired blepharoptosis include neurogenic, mechanical, traumatic, and myogenic etiologies. The most common cause, particularly in the elderly population, is involutional, or senile ptosis, caused by dehiscence of the levator aponeurosis insertion.^{38,39}

Congenital Blepharoptosis

Congenital blepharoptosis, typically seen in children, necessitates evaluation of the MRD1, levator muscle excursion, eyelid crease height, and exclusion of syndromes. Congenital blepharoptosis is most frequently caused by embryonic failure of levator muscle development. Surgical treatment is typically indicated, and usually happens at approximately 4 to 5 years of age.⁴⁰ A common technique is the frontalis sling, which essentially connects the frontalis muscle to the tarsus for support in elevation. This can be accomplished with either autologous or alloplastic materials.^{38,41} This procedure can be performed through a supratarsal crease incision or minimally invasively via small puncture skin incisions used to thread suspension material through.⁴² Autologous fascia lata is a preferred medium for suspension, as it carries the lowest risk, though the fascia lata cadaveric allograft is also an option. Permanent suture, though less common, can also be used to create a sling.³⁸ More recently, an alternative approach has been described, involving a frontalis muscle advancement flap. This approach is performed through a supratarsal eyelid crease incision, as well, and involves elevation of the frontalis muscle in the supraperiosteal plane and plication of the muscle to the levator aponeurosis.^{37,43} A recent study by Sakahara et al describes a modified frontalis suspension using a single rhomboid-shaped fascial strip. They found that this technique was successful in correcting unilateral congenital ptosis, and that correcting it led to an increase in visual acuity.⁴⁰ Advances are also being made in

revision surgery for undercorrected blepharoptosis, with a recent retrospective case series describing a method of revising the frontalis sling using autogenous fascia lata.⁴⁴

Acquired Blepharoptosis

The most common type of acquired blepharoptosis is involutional, or senile ptosis, which will be the focus of our discussion here. As mentioned previously, it is caused by the disinsertion or dehiscence of the levator aponeurosis from the tarsus. On clinical examination, one would expect to see generally poor levator function, with worsening of the ptosis on downward gaze, and a high lid crease. Fortunately, these patients tend to do quite well with surgical intervention.⁴⁵

Surgical repair is either performed via an internal or an external approach. There are multiple approaches to internal repair of ptosis. The Muller's muscle conjunctiva resection (MMCR) uses eyelid response to phenylephrine placed in the superior fornix to determine the degree of resection of the Muller's muscle and conjunctiva required. With this internal approach, the literature suggests favorable results in terms of symmetry and low reoperation rates.⁴⁶ Another internal approach, called the Fasanella-Servat procedure, corrects ptosis by excising conjunctiva, Muller's muscle, and tarsus from posteriorly.³⁷ A more recently described method termed the "small-incision external approach" involves, as the title suggests, a smaller incision than the traditional external approach. The smaller-incision approach uses an incision of approximately 8 to 10 mm in length, while the traditional approach uses an incision of roughly 20 to 22 mm in length. Not only does the small-incision technique utilize a smaller incision, it also offers the ability to perform the procedure without necessarily exposing the orbital septum. While studies have compared the Fasanella-Servat procedure to the traditional external approach technique, only recently a retrospective review compared the small-incision approach to the Fasanella-Servat technique.⁴⁷ This study demonstrated that both the Fasanella-Servat and small-incision methods result in comparable patient satisfaction, while the Fasanella-Servat led to a shorter operative time. However, the latter resulted in increased reported post-operative pain.⁴⁷

Paralytic Lagophthalmos

Lagophthalmos, or an inability to achieve full eye closure, is a serious condition that can lead to exposure keratitis, corneal ulcer, corneal perforation, or even blindness.⁴⁸ Causes include paralysis of the orbicularis oculi muscle, thyroid disease, trauma, and orbital neoplasms.⁴⁹ Conservative and initial treatment should focus on globe protection, and must include lubrication and physical procedure with taping and/or scleral shells/eye bubbles. In patients in whom recovery is not expected, or recovery is not expected quickly, surgical repair is recommended. Given the robust quantity of information in the literature regarding lagophthalmos, and more specifically paralytic lagophthalmos, we will limit our discussion here to current research and novel techniques for management.

Historically, methods to correct lagophthalmos have included tarsorrhaphy, lid weighting, placement of eyelid spring, levator palpebrae superioris lengthening, and chemodeneration.⁵⁰ Currently, the most common surgical management of lagophthalmos is the insertion of a weighted implant into the upper eyelid. While the gold weight was for many years the mainstay of implants, it has been replaced significantly by the platinum weight, particularly the thin-profile platinum weight. This is due to an abundance of research demonstrating superior results with the platinum weight, and fewer complications. Gold weights have been found to result in a high complication rate and a cosmetically unacceptable rate of visibility under the skin. The complication rate has been reported as high as 50% in some studies, and includes local inflammation, astigmatism, implant extrusion and migration, and infection.⁵⁰⁻⁵² A large case series of 100 patients who underwent eyelid weighting with a thin-profile platinum weight was published in 2009 by Silver et al, which reported both excellent functional outcomes as well as a reduced rate of capsule formation and extrusion when compared to gold weights.⁵⁰

Upper eyelid chains offer an alternative method of lid loading, and like weights are also available in both gold and platinum. Interest in eyelid chains developed as a response to the negative side effects associated with rigid weights, particularly gold weights. A landmark study by Berghaus et al compared the then-newly designed platinum chain to the standard rigid gold implant, and reported better results with fewer complications.⁵² Since then, multiple other studies have compared the platinum chain to the gold weight, and all have reported better cosmetic results with the chain—namely less visibility and better eyelid contour—and fewer complications.^{53,54} The authors were unable to find any comparisons of platinum chains to platinum weights in the literature, and this may represent an opportunity for future research.

Over the last several years, there have been several articles produced discussing the use of hyaluronic acid filler in the treatment of paralytic lagophthalmos. One study published in *Laryngoscope* in 2013 described this so-called "hyaluronic acid gel weight," and proposed this as an effective way to reduce paralytic lagophthalmos, particularly those individuals with a palpebral fissure of no greater than 6.5 mm with attempted eye closure.⁵⁵ Another retrospective case series of nine patients reported significant improvement in lagophthalmos, and suggested that this may be most useful in patients who are poor surgical candidates, and/or those patients in whom facial nerve function is expected.⁵⁶ Advantages of injectable hyaluronic acid filler for lagophthalmos in general include the fact that it is minimally invasive, titratable, and reversible.⁵⁷ Complications reported are relatively minor and include pain at the injection side, temporary ecchymosis, and edema.^{55,56}

Conclusion

Eyelid malposition encompasses a diverse array of clinical and surgical challenges for the facial plastic and reconstructive surgeon. The clinician must become an expert in not only the diagnosis and surgical management of these conditions,

but also preoperative evaluation and appropriate management of expectations. In addition to the risk of serious damage to the globe and cornea from exposure, eyelid malposition can lead to significant psychological distress. For these reasons, it is of paramount importance that the surgeon be aware of the multifactorial, complex nature of these disorders. Overall, the goal is to restore as best as possible the natural anatomical alignment of the eyelid and reduce the risk of injury to the globe.⁵⁸

Conflict of Interest

None declared.

References

- Papel ID. *Blepharoplasty: Thomas Procedures in Facial Plastic Surgery*. Shelton, CT: People's Medical Publishing House; 2012
- Codner MA, McCord CD Jr. *Eyelid and Periorbital Surgery*. Boca Raton, FL: CRC Press; 2016
- Hahn S, Desai SC. Lower lid malposition: causes and correction. *Facial Plast Surg Clin North Am* 2016;24(02):163–171
- Yang P, Ko AC, Kikkawa DO, Korn BS. Upper eyelid blepharoplasty: evaluation, treatment, and complication minimization. *Semin Plast Surg* 2017;31(01):51–57
- Wolfley DE, Guibor P. Preoperative evaluation of the blepharoplasty patient. *Facial Plast Surg* 1984;1(04):284–291
- Jelks GW, Jelks EB. Preoperative evaluation of the blepharoplasty patient. Bypassing the pitfalls. *Clin Plast Surg* 1993;20(02):213–223, discussion 224
- Gladstone G, Myint S, Black E, Brazzo B. *Eyelid Reconstruction*. Berlin, Heidelberg: Springer; 2002
- Damasceno RW, Osaki MH, Dantas PEC, Belfort R Jr. Involuntary entropion and ectropion of the lower eyelid: prevalence and associated risk factors in the elderly population. *Ophthal Plast Reconstr Surg* 2011;27(05):317–320
- Patipa M. The evaluation and management of lower eyelid retraction following cosmetic surgery. *Plast Reconstr Surg* 2000;106(02):438–453, discussion 454–459
- Wesley RE, Collins JW. Combined procedure for senile entropion. *Ophthalmic Surg* 1983;14(05):401–405
- Parsa AA, Lye KD, Radcliffe N, Parsa FD. Lower blepharoplasty with capsulopalpebral fascia hernia repair for palpebral bags: a long-term prospective study. *Plast Reconstr Surg* 2008;121(04):1387–1397
- Jang SY, Choi SR, Jang JW, Kim SJ, Choi HS. Long-term surgical outcomes of Quickert sutures for involutional lower eyelid entropion. *J Craniomaxillofac Surg* 2014;42(08):1629–1631
- Quickert MH, Rathbun E. Suture repair of entropion. *Arch Ophthalmol* 1971;85(03):304–305
- Barrett RV, Meyer DR. The modified Bick quick strip procedure for surgical treatment of eyelid malposition. *Ophthal Plast Reconstr Surg* 2012;28(04):294–299
- Golan S, Lelli G. Involuntary entropion repair combining the modified Bick quick strip procedure with Quickert rotational sutures. *Orbit* 2018;1–3 (e-pub ahead of print). . Doi: 10.1080/01676830.2018.1497066
- Baek JS, Choi SC, Jang SY, Lee JH, Choi HS. Comparison of surgical outcome between quickert suture and quickert suture with modified lateral tarsal strip in involutional lower eyelid entropion. *J Craniofac Surg* 2016;27(01):198–200
- Pereira MG, Rodrigues MA, Rodrigues SA. Eyelid entropion. *Semin Ophthalmol* 2010;25(03):52–58
- Bleyen I, Dolman PJ. The Wies procedure for management of trichiasis or cicatricial entropion of either upper or lower eyelids. *Br J Ophthalmol* 2009;93(12):1612–1615
- Verity DH, Collin JRO. Eyelid reconstruction: the state of the art. *Curr Opin Otolaryngol Head Neck Surg* 2004;12(04):344–348
- Osaki T, Sant'Anna A, Osaki M, et al. Management of severe cicatricial entropion with labial mucous membrane graft in cicatricial ocular surface disorders. *J Craniofac Surg* 2018;29(06):1531–1534
- Pandey N, Jayaprakasam A, Feldman I, Malhotra R. Upper eyelid levator-recession and anterior lamella repositioning through the grey-line: avoiding a skin-crease incision. *Indian J Ophthalmol* 2018;66(02):273–277
- Anderson RL, Gordy DD. The tarsal strip procedure. *Arch Ophthalmol* 1979;97(11):2192–2196
- Georgescu D. Surgical preferences for lateral canthoplasty and canthopexy. *Curr Opin Ophthalmol* 2014;25(05):449–454
- Mitchell DA, Lyons AB, Moy RL. Correction of cicatricial and involutional lower eyelid ectropion with hyaluronic acid. *JAAD Case Rep* 2018;4(07):628–630
- Sufyan AS, Lee HBH, Shah H, Nunery WR, Kokoska MS, Shipchandler TZ. Single-stage repair of paralytic ectropion using a novel modification of the tarsoconjunctival flap. *JAMA Facial Plast Surg* 2014;16(02):151–152
- Tao JP, Vemuri S, Patel AD, Compton C, Nunery WR. Lateral tarsoconjunctival onlay flap lower eyelid suspension in facial nerve paresis. *Ophthal Plast Reconstr Surg* 2014;30(04):342–345
- Dedhia R, Hsieh TY, Chin O, Shipchandler TZ, Tollefson TT. Outcomes from lateral eyelid coupling for facial paralysis using the modified tarsoconjunctival flap. *JAMA Facial Plast Surg* 2018;20(05):381–386
- Romero R, Sanchez-Ortiz M, Granados M, et al. Use of hyaluronic acid gel in the management of cicatricial ectropion: results and complications. *Orbit* 2013;32(06):362–365
- Fezza JP. Nonsurgical treatment of cicatricial ectropion with hyaluronic acid filler. *Plast Reconstr Surg* 2008;121(03):1009–1014
- Tarallo M, Rizzo MI, Monarca C, Fanelli B, Parisi P, Scuderi N. Optimal care for eyelid contraction after radiotherapy: case report and literature review. *J Oral Maxillofac Surg* 2012;70(10):2459–2465
- Kim KH, Baek JS, Lee S, et al. Causes and surgical outcomes of lower eyelid retraction. *Korean J Ophthalmol* 2017;31(04):290–298
- Mehta HK. Myotarsal flap—a versatile entity for lower eyelid reconstructions. *Orbit (London)* 2018;37(03):223–229
- Li TG, Shorr N, Goldberg RA. Comparison of the efficacy of hard palate grafts with acellular human dermis grafts in lower eyelid surgery. *Plast Reconstr Surg* 2005;116(03):873–878, discussion 879–880
- Pascali M, Botti C, Cervelli V, Botti G. Vertical midface lifting with periorbital anchoring in the management of lower eyelid retraction: a 10-year clinical retrospective study. *Plast Reconstr Surg* 2017;140(01):33–45
- Le Louarn C. Concentric malar lift in the management of lower eyelid rejuvenation or retraction: a clinical retrospective study on 342 cases, 13 years after the first publication. *Aesthetic Plast Surg* 2018;42(03):725–742
- Murchison AP, Sires BA, Jian-Amadi A. Margin reflex distance in different ethnic groups. *Arch Facial Plast Surg* 2009;11(05):303–305
- Cohen AJ, Weinberg DA. *Evaluation and Management of Blepharoptosis*. New York, NY: Springer; 2011
- Baroody M, Holds JB, Vick VL. Advances in the diagnosis and treatment of ptosis. *Curr Opin Ophthalmol* 2005;16(06):351–355
- Hwang K, Ko YS. Improvement of the marginal reflex distance-1 in blepharoptosis surgeries. *J Craniofac Surg* 2016;27(02):455–460
- Sakahara D, Imai K, Masuoka T, et al. Long-term functional and aesthetic evaluation of using a single rhomboid-shaped fascial strip for severe congenital unilateral blepharoptosis. *J Plast Reconstr Aesthet Surg* 2018;71(11):1618–1624

- 41 Philandrianos C, Galinier P, Salazard B, Bardot J, Magalon G. Congenital ptosis: long-term outcome of frontalis suspension using autogenous temporal fascia or fascia lata in children. *J Plast Reconstr Aesthet Surg* 2010;63(05):782–786
- 42 Yip CC, Goldberg RA, Cook TL, McCann JD. Incision-less frontalis suspension. *Br J Ophthalmol* 2004;88(04):585–586
- 43 Ramirez OM, Peña G. Frontalis muscle advancement: a dynamic structure for the treatment of severe congenital eyelid ptosis. *Plast Reconstr Surg* 2004;113(06):1841–1849, discussion 1850–1851
- 44 Lee JH, Woo KI, Kim YD. Revision surgery for undercorrected blepharoptosis after frontalis sling operation using autogenous fascia lata. *Ophthalm Plast Reconstr Surg* 2018;34(05):487–490
- 45 Tovilla J. Involutional ptosis. In: Cohen A, Weinberg D, eds. *Evaluation and Management of Blepharoptosis*. New York, NY: Springer; 2011
- 46 Liu CY, Chhadva P, Setabutr P. Blepharoptosis repair. *Curr Opin Otolaryngol Head Neck Surg* 2018;26(04):221–226
- 47 Sohrab MA, Lissner GS. Comparison of fasanella-servat and small-incision techniques for involutional ptosis repair. *Ophthalm Plast Reconstr Surg* 2016;32(02):98–101
- 48 Choi HY, Hong SE, Lew JM. Long-term comparison of a newly designed gold implant with the conventional implant in facial nerve paralysis. *Plast Reconstr Surg* 1999;104(06):1624–1634
- 49 Rozen S, Lehrman C. Upper eyelid postseptal weight placement for treatment of paralytic lagophthalmos. *Plast Reconstr Surg* 2013;131(06):1253–1265
- 50 Silver AL, Lindsay RW, Cheney ML, Hadlock TA. Thin-profile platinum eyelid weighting: a superior option in the paralyzed eye. *Plast Reconstr Surg* 2009;123(06):1697–1703
- 51 Nunes TP, Sardinha M, Pereira IC, Lunardelli P, Matayoshi S. Gold weight implantation: premature and late complications [in Portuguese]. *Arq Bras Oftalmol* 2007;70(04):599–602
- 52 Berghaus A, Neumann K, Schrom T. The platinum chain: a new upper-lid implant for facial palsy. *Arch Facial Plast Surg* 2003;5(02):166–170
- 53 Bladen JC, Norris JH, Malhotra R. Cosmetic comparison of gold weight and platinum chain insertion in primary upper eyelid loading for lagophthalmos. *Ophthalm Plast Reconstr Surg* 2012;28(03):171–175
- 54 Siah WF, Nagendran S, Tan P, Ali Ahmad SM, Litwin AS, Malhotra R. Late outcomes of gold weights and platinum chains for upper eyelid loading. *Br J Ophthalmol* 2018;102(02):164–168
- 55 Martín-Oviedo C, García I, Lowy A, Scola E, Aristegui M, Scola B. Hyaluronic acid gel weight: a nonsurgical option for the management of paralytic lagophthalmos. *Laryngoscope* 2013;123(12):E91–E96
- 56 Mancini R, Taban M, Lowinger A, et al. Use of hyaluronic Acid gel in the management of paralytic lagophthalmos: the hyaluronic Acid gel “gold weight”. *Ophthalm Plast Reconstr Surg* 2009;25(01):23–26
- 57 Tan P, Kwong TQ, Malhotra R. Non-aesthetic indications for periocular hyaluronic acid filler treatment: a review. *Br J Ophthalmol* 2018; 102(06):725–735
- 58 Bergstrom R, Czyz CN. *Eyelid Reconstruction, Entropion*. Treasure Island, FL: StatPearls; 2018