

# Dermal Fillers for the Treatment of Tear Trough Deformity: A Review of Anatomy, Treatment Techniques, and their Outcomes

Tear trough deformity is a major concern in a lot of individuals seeking periorbital rejuvenation. A prominent tear trough deformity is characterised by a sunken appearance of the eye that results in the casting of a dark shadow over the lower eyelid, giving the patient a fatigued appearance despite adequate rest, and is refractory to attempts at cosmetic concealment. The tear trough deformity is a natural consequence of the anatomic attachments of the periorbital tissues. A variety of techniques have evolved to address this cosmetic issue. Traditional techniques relied on surgical excision of skin, muscle, and fat as well as chemical peels. Treatment is now tailored towards specific anatomic abnormalities and often employs multiple modalities including surgery, botulinum toxin, and replacement of volume. Various original research articles, text book publications and review articles were studied. Data specific to the historical aspect and anatomy of tear trough have been enumerated. Techniques of different authors were analysed and their results and complications have been summarised. The technique of the author has also been described here.

**KEYWORDS:** Dark circles, filler, hyaluronic acid, tear trough, under eye

## INTRODUCTION

Tear trough deformity is a major concern in a lot of individuals seeking periorbital rejuvenation. A prominent tear trough deformity is characterised by a sunken appearance of the globe that results in the casting of a dark shadow over the lower eyelid, giving the patient a fatigued appearance despite adequate rest, and is refractory to attempts at cosmetic concealment. Under-eye circles caused by tear trough deformity can be confirmed and shown to the patient along with their disappearance when the patient is photographed using flash photography.<sup>[1]</sup>

The tear trough deformity is a natural consequence of the anatomic attachments of the periorbital tissues. A variety of techniques have evolved to address this cosmetic

issue. Traditional techniques relied on surgical excision of skin, muscle, and fat as well as chemical peels. More recently, surgeons have better appreciated the need for restoration of volume of the orbit as part of an overall rejuvenation strategy. Treatment is now tailored towards specific anatomic abnormalities and often employs multiple modalities including surgery, botulinum toxin, and replacement of volume.

To quote Glaser *et al.*, "The aesthetically attractive lower eyelid should display a relatively smooth transition between the pre-septal and orbital portions of the orbicularis oculi muscle and continue into the upper malar region without a definable transition point."<sup>[2]</sup>

Dark circles are often a result of tear trough deformity [Figure 1]. However, the causes of dark circles can be multi-factorial. Changes in skin thickness, laxity, hyperpigmentation and actinic changes also play a role. Thin skin or prominent subcutaneous venous pooling accentuates the periorbital darkening.<sup>[1,3]</sup>

Additionally, prolapse of orbital fat may indirectly cause a shadowing over the lower lids.<sup>[4]</sup>

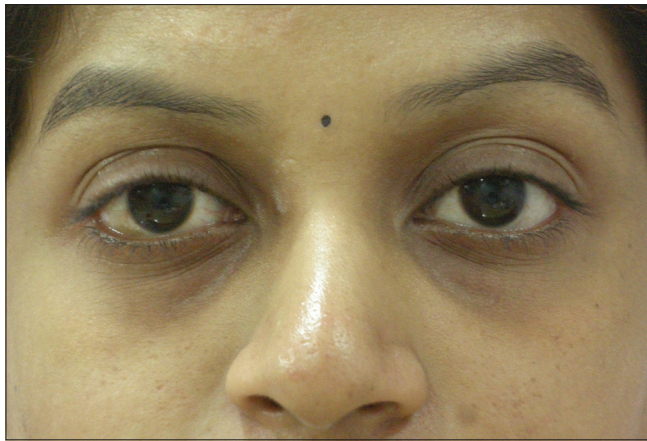
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**Figure 1:** Tear trough deformity resulting in dark circles in a young Indian female

**ANATOMY**

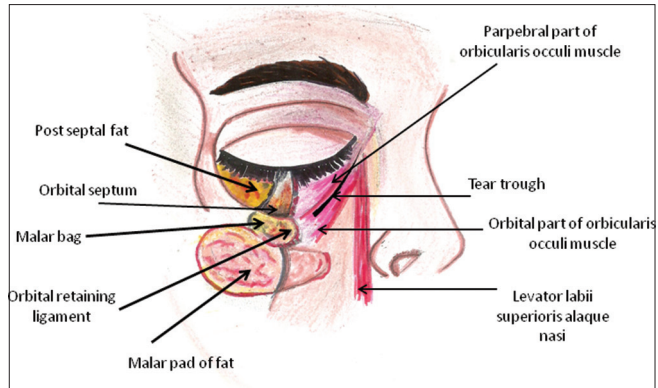
Duke-Elder and Wybar first introduced the term nasojugal fold in 1961. They defined it as “running downwards and outwards from the inner canthus, the junction of the loose tissue of the lower lid with the denser structure of the cheek, marking the line along which the fascia is anchored to the periosteum between the muscles of the lid and those of the upper lip.”<sup>[5]</sup>

According to Loeb, the ‘nasojugal groove’ was caused by the following: (1) Fixation of the orbital septum at the level of the inferomedial portion of the arcus marginalis, (2) existence of a triangular gap limited by the lateral portion of the angular muscle on one side and the medial portion of the orbicularis oculi muscle on the other and (3) the absence of fat tissue from the central and medial fat pads subjacent to the orbicularis oculi muscle in the area below the groove.<sup>[6]</sup>

The term ‘tear trough deformity’ was coined by Flowers. In his opinion, descent of the cheek, loss of facial volume, underdevelopment of the infraorbital malar complex and a muscular defect between the orbicularis muscle and angular head of the quadratus labii superioris muscle were all responsible for the formation of tear trough deformity.<sup>[7]</sup>

Haddock said the term ‘tear trough deformity’ should be applied to the medial periorbital hollow extending obliquely from the medial canthus to the midpupillary line [Figure 2]. Lateral to this, the depression is better referred to as the ‘palpebromalar groove’, ‘nasojugal groove’, or the ‘lid-cheek junction’.<sup>[8-11]</sup>

In their cadaveric dissection studies, Muzaffar *et al.* describe an orbicularis retaining ligament in the lower eyelid that originates laterally as a reflection of the septum orbitale joining a membrane derived from the preperiosteal fat over the zygoma.<sup>[10]</sup> The medial extent of this retaining ligament is variable, connecting with the



**Figure 2:** Anatomy of tear trough deformity

orbicularis oculi muscle insertion and thus indirectly to the medial canthus. The central portion of the retaining ligament is the weakest and distends differentially more with age, allowing for greater exposure of the central fat pad. Greater laxity of the lid-cheek junction with age contributes to the tear trough deformity by accentuating the herniation of orbital fat.<sup>[10]</sup> Midface ptosis helps to bare the tear trough, as involutional descent of the midface with the orbicularis muscle tethered over the tear trough by the orbicularis retaining ligament results in thinning of the tissues over the tear trough and increased prominence, readily recognizable as a sign of ageing.<sup>[12]</sup>

Kane describes the tear trough as a depression centred over the medial inferior orbital rim and bounded superiorly by the infraorbital fat protuberance. As the patient ages, the globe descends within the orbit and the infraorbital fat is displaced anteriorly. This anterior bulge causes the tear trough to deepen. Because this protuberance creates shadowing below it, it causes the apparent tear trough deformity to deepen further, depending on the conditions of lighting. The inferior border of the tear trough is formed by the thick skin of the upper cheek with its abundant subcutaneous fat, suborbicularis oculi fat and portions of the malar fat pad. In most individuals, the trough is deeper medially, becoming shallower laterally. The thin skin at the depth of this groove has very little fat beneath it, contributing to the apparent depression. With age, further loss of soft tissue and, importantly, a loss of osseous support also causes the tear trough to deepen further.<sup>[13]</sup>

Sadick *et al.* proposed a tear trough rating scale (TTRS). According to this TTRS, it was found that the tear trough was not simply an age-related deformity. It is often related to a forward projection of the bone of the upper cheek, and it may be more common in patients with either congenital or age-related maxillary hypoplasia. They said that the tear trough should be defined as the depression of the medial lower eyelid just lateral to the anterior lacrimal crest and limited in its inferior aspect by the inferior orbital rim. This region corresponds anatomically to where the lacrimal sac lies; hence the term tear trough.<sup>[1]</sup>

In a recent publication, Wong *et al.* described a tear trough ligament after dissecting 48 cadaveric hemi faces. A true osteocutaneous ligament called the tear trough ligament was consistently found on the maxilla, between the palpebral and orbital parts of the orbicularis oculi, cephalad and caudal to the ligament, respectively. It commences medially, at the level of the insertion of the medial canthal tendon, just inferior to the anterior lacrimal crest, to approximately the medial-pupil line, where it continues laterally as the bilayered orbicularis retaining ligament. Histologic evaluation confirmed the ligamentous nature of the tear trough ligament, with features identical to those of the zygomatic ligament.<sup>[14]</sup>

**CLASSIFICATION**

In an effort to objectively analyse their postoperative results, Barton *et al.* proposed a grading system based on anatomic analysis [Table 1].<sup>[15]</sup>

Sadick *et al.* developed the TTRS by objectively and subjectively evaluating the clinical appearance of the tear trough with regard to depth of the trough, hyperpigmentation, volume of prolapsed fat and skin rhytidosis.<sup>[1]</sup>

A numerical score was then assigned with respect to severity, depth of the tear trough, distance from the anterior lacrimal crest to the depth of the trough; each millimetre of depth is given one point.

**Hyperpigmentation**

Dyspigmentation, although not directly contributing to the depth of the trough, creates an illusion of depth; no hyperpigmentation is given one point, mild is given two points, moderate hyperpigmentation is given three points and intense or deep hyperpigmentation is given four points; subdermal dark casting caused by venous pooling can also be graded as hyperpigmentation.

**Prolapse of nasal fat pad/pockets**

Prominent prolapse of the nasal fat pad accentuates the depth of the trough and is rated as mild (one point), moderate (two points) or severe (three points).

**Table 1: Barton’s grading system based on anatomic analysis**

Grade	Description
0	Absence of medial or lateral lines demarcating the arcus marginalis or the orbital rim, and a smooth, youthful contour without a transition zone at the orbit-cheek junction
I	Mild, subtle presence of a medial line or shadow; smooth lateral transition of lid-cheek junction
II	Moderate prominence of a visible demarcation of the lid-cheek junction, extending from medial to lateral
III	Severe demarcation of the orbit-cheek junction, with an obvious step between the orbit and the cheek

**Rhytidosis**

Lower eyelid skin rhytidosis accentuates the fatty prolapse and the depth of the trough; skin rhytidosis is rated on a scale of one to four (mild, moderate, advanced and severe, according to Glogau scale) and the rating corresponds to the number of points assigned.

In 2010, Hirmand proposed a classification system of the tear trough deformity based on clinical evaluation<sup>[16]</sup> [Figures 3-5, Table 2].

**CONTRAINDICATIONS**

1. Unrealistic expectations
2. Infection near the site of injection
3. Known allergy or hypersensitivity to the material or to the lidocaine mixed in the syringe of the filler<sup>[17]</sup>
4. Patients with septal fat herniation
5. Severe elastosis (e.g., dermatochalasis or large eye bags)<sup>[18]</sup>

**PRECAUTIONS**

1. Vitamin E, ginkgo biloba, aspirin and nonsteroidal anti-inflammatory drugs (NSAIDs) should be avoided at least five days before the treatment to prevent bruising.
2. Care should be taken in patients with a history of lower eyelid blepharoplasty without lateral retinacular suspension.
3. One should be cautious while injecting around the infraorbital foramen to avoid injury to the neurovascular bundle.
4. Careful and gentle moulding of the implant for a more homogeneous distribution of the material is encouraged after injection to obtain an even distribution of the filler in the lateral part of the hollow.

**TECHNIQUES**

In a 2006 multispecialty consensus recommendation article, the tear trough was listed as the most challenging area to treat with hyaluronic acid (HA).<sup>[19]</sup> The currently popular HA fillers are produced by bacterial fermentation (*Streptococcus* strains) and stabilised by chemical

**Table 2: Hirmand’s classification system of the tear trough deformity based on clinical evaluation**

Class	Clinical description
I	Patients have loss of volume, limited medially to the tear trough. These patients can also have mild flattening extending to the central cheek
II	Patients exhibit loss of volume in the lateral orbital area in addition to the medial orbit, and they may have moderate deficiency of volume in the medial cheek and flattening of the central upper cheek
III	Patients present with a full depression circumferentially along the orbital rim, medial to lateral

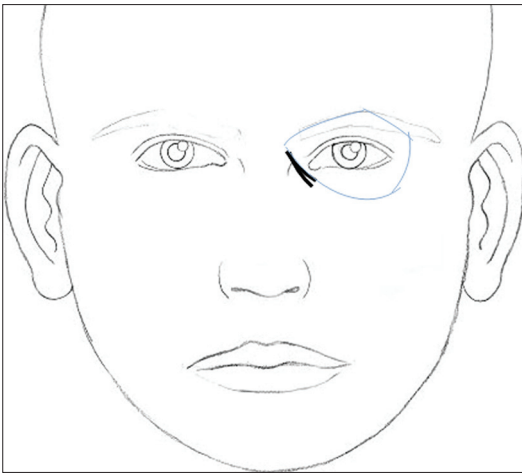


Figure 3: Hirmand's class 1

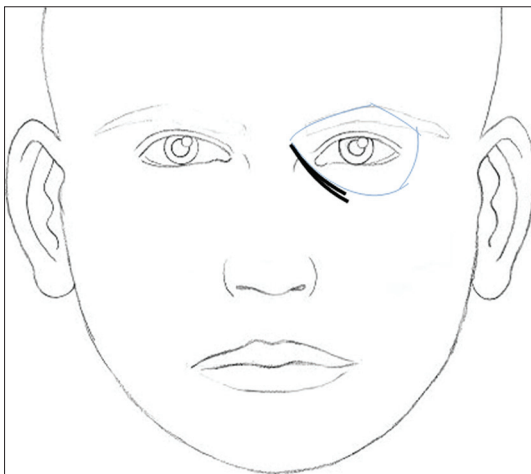


Figure 4: Hirmand's class 2

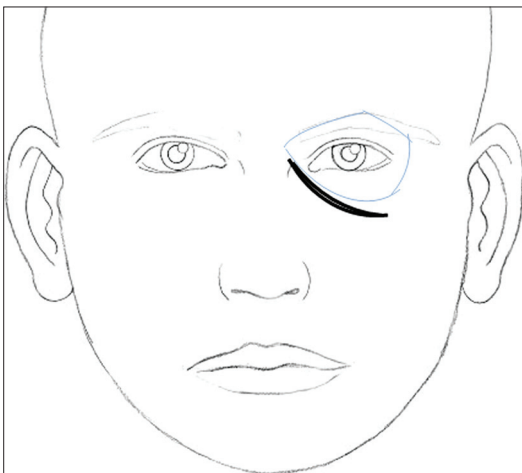


Figure 5: Hirmand's class 3

cross-linking. The nonanimal-derived products have substantially decreased allergic reactions.<sup>[20]</sup> The products differ in their cross-linking methods, concentrations, and size of particles.<sup>[21,22]</sup>

### Lambros's technique

Lambros stressed that when one engages in nonsurgical treatment for tear trough correction, it is important to evaluate the following factors:<sup>[23]</sup>

1. Skin quality, as patients with thick, smooth skin will have better results than those with thin extremely wrinkled skin.
2. Definition of the hollow, as a more defined hollow is more amenable to fillers.
3. The orbital fat pad, as larger fat pads are more difficult to correct due to 'puffiness' caused by the injection.
4. The colour of the overlying skin, as the filler may improve shadowing but will not improve dark pigmentation.

After application of an ice pack to the lower lid and cheek, a local anesthetic consisting of 0.5% lidocaine with epinephrine (0.2 to 0.4 mL) is injected into the orbicularis within the boundaries of the tear trough. Finger pressure is applied to flatten the area of injection. A half-inch, 30-gauge needle is inserted through the skin at the most lateral extent of the tear trough, advancing fully and potentially indenting the skin with the hub for full reach. The HA is then injected deep into the dermis as the needle is withdrawn. This process is repeated above and below the original site of the injection. The area is then inspected, and additional passes are made as needed to yield a smooth contour. Last, the area is massaged lightly, compressed with finger pressure, and rolled with a cotton applicator. In his description of the technique, Lambros stressed the importance of not forcefully compressing the product during massage, as this can displace the product into the cheek and exaggerate the tear trough. Postinjection care involves applying ice to the area the night of the procedure, and patients are instructed to refrain from massaging the area.

### Kane's technique

After evaluation and marking of the tear trough, betacaine topical anaesthetic ointment is applied to the lower eyelids at least 20 minutes before the injection.<sup>[13]</sup> After preparation of skin with alcohol, a 30- or 32-gauge needle is inserted for injection. The skin of the lower lid is spread and held at some tension with the noninjecting hand. The skin is inspected carefully for visible vessels before each needle stick. The deepest portion of the medial tear trough is treated first. The needle is threaded below the surface of the skin above the orbicularis oculi. A miniscule amount of hyaluronic filler is injected at each pass. Parallel threads of the filler are injected cephalad and caudal to the tear trough. The raised area of the filler is then tapered off medially along the nasal sidewall superiorly at the most cephalad-significant rhytid, inferiorly at least

abutting or immediately caudal to the thick skin of the cheek, and laterally to at least the junction of the medial and lateral third of the inferior orbital rim. If the tear trough is deep, the direction of the needle is changed throughout the injection so that the filler is applied in a cross-hatched fashion. The volume range is 0.1 to 0.45 mL per eyelid, with most patients requiring 0.2 to 0.3 mL.

### Technique of stutman and codner

With the patient seated, the tear trough deformity and lid-cheek junction are marked with easily removable white eyeliner. The patient is advised to apply ice packs to the area several minutes before injection to minimise bruising and for anaesthetic purposes. After the markings are confirmed by the patient, HA is injected deep in the preperiosteal plane, to reduce visibility of the product. The HA is placed beneath the insertion of the medial orbicularis muscle at the maxilla and continues laterally inferior to the orbicularis retaining ligament. A combination of crosshatching and linear threading is utilised with a 30-gauge needle with care not to inject superficially. The product is lightly massaged with cotton-tipped applicators to disperse any visible irregularities. After injection, the patient is instructed to apply ice to the area over the next 24 hours as needed to decrease oedema and ecchymosis.<sup>[24]</sup>

### The technique of kenneth and samantha steinsapir

Kenneth and Samantha reported a technique of deep HA filler injections in 164 patients with tear trough. The mean dose of filler per session was 1.53, 0.8, 0.84 and 0.38 mL divided between the two lower eyelids. The goal was to place aliquots of the filler in the preperiosteal tissues just inferior to the orbital rim. It was sometimes necessary to digitally elevate the inferior orbital fat in the lower eyelid to expose the desired injection site. The bony orbital rim is free of significant vascular structures from the base of the anterior lacrimal crest to the lateral canthal tendon. The filler was introduced by using a serial puncture technique. Patients were permitted to close their eyes. The orbital rim was digitally palpated and the needle rotated so that the bevel was parallel to the skin and advanced to be flush on the periosteum. Before injection, the impaled soft tissue was digitally pulled over the needle like curtains over a curtain rod (curtain manoeuvre). This decreased the risk of backflow of the filler in a more superficial plane. At each site, approximately 0.1 mL was injected. The needle was withdrawn and the filler moulded to the desired contour.<sup>[25]</sup>

### Technique of patel and glaser

Patel and Glaser have described a similar technique. HA filler was injected by using a serial point injection or linear threading technique and massaged using a cotton-tipped swab or a digit. Small aliquots of filler

just inferior to the orbital rim at a plane between the periosteum and the orbicularis oculi muscle were also injected to correct loss of volume in the lower eyelid area due to pseudoherniation, orbital septal laxity and atrophy of the midface. The filler material was carefully massaged to allow even distribution.<sup>[2]</sup>

### Consensus group technique: Anatomic guidelines for augmentation of the cheek and infraorbital hollow

To be able to teach others how to improve aesthetic outcomes in the midface and infraorbital hollows, a consensus group of European and North and South American aesthetic experts convened at an academic workshop to develop keys to optimal outcomes. The best practice guidelines for midface and infraorbital hollow injections were discussed. The consensus group recommend vertical supraperiosteal depot technique (VSDT) or linear threading for infraorbital hollow augmentation.

VSDT uses only single, small depots of soft tissue filler material that are placed via a vertical injection on a location directly on the bone or, more exactly, on the periosteum. Due to the bony support, only very little material is needed to produce a pronounced correction at the surface of the skin. The intention in using this technique is to avoid overcorrection.<sup>[26]</sup>

According to the consensus team, the filler should be injected at the supraperiosteal level along or below the orbital rim under the defect or both, protecting the edge of the rim to prevent deposition of filler above that structure.<sup>[27]</sup> Most of the filler should be injected underneath the orbicularis oculi muscle. However, the medial part of the muscle, which attaches to the bone, requires direct injection into the muscle itself. Serial injections using VSDT, implanting 0.02 to 0.05 mL per perpendicular injection point just above the bone 2 to 3 mm apart, are recommended. The linear technique is preferred if the cheek has been augmented well, using an entry point beneath the lateral and, in some cases, also the medial canthus. The cannula (or needle) should be placed perpendicular to the skin, advanced to the periosteum, and moved forward until it reaches the top of the nasojugal fold. This technique allows for deep injection using retrograde linear threading along the orbital rim, as described above. The injected volume depends on the severity of hollowing [Table 3]. Repeated injections may be required for optimal augmentation.

Patrick Trevidic has reported the use of blunt-tipped cannulas for tear trough correction with HA fillers.<sup>[28]</sup> Blunt-tipped cannulas are safer, because the chance of injuring vessels and nerves is smaller than with needles. It is less painful and produces less oedema.

**Table 3: Recommendations for hyaluronic acid filler to be injected depending on the grade of severity**

Grade	Severity	Dosage
I	Mild hollowing	0.5 mL/side divided into 0.05 mL per point (2-3 mm apart)
II	Moderate hollowing	Up to 1 mL/side
III	Severe hollowing	Up to 1 mL/side
IV	Very severe hollowing	1 mL/side and multiple sessions in 4-week intervals of approximately 4 weeks if required

**The author’s technique**

Patients on vitamin E, ginkgo biloba and NSAIDs are asked to discontinue the same for a week before the treatment to prevent bruising.

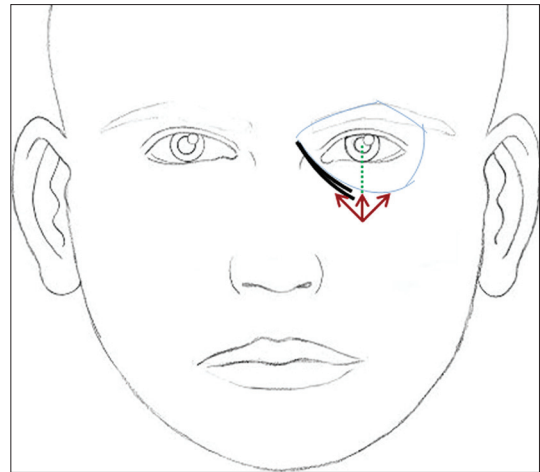
All the patients are photographed with a standard powershot camera with the same settings and adequate lighting. Written informed consent is taken.

The author prefers to inject with the patient reclined at 45° as the tear trough deformity is better visible in this position than when the patient is lying down. Good lighting is extremely important for better visibility of anatomical landmarks. The injections should not be given in a hurry as chances of hitting blood vessels or injecting superficially are higher when in haste.

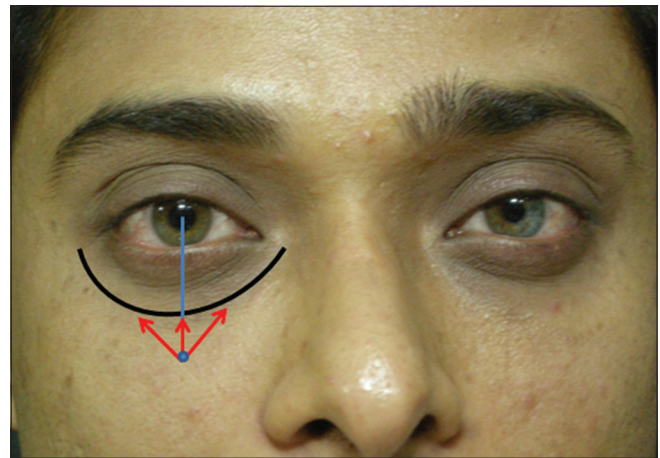
Any cosmetic makeup in the area to be treated is completely removed with a cleansing lotion. Cleansing is further done with chlorhexidine and normal saline. The area to be treated is numbed with ice cubes. The orbital rim is palpated. Due to the rich subdermal vascular plexus, the tear trough area is prone to significant bruising. Hence, the author prefers to keep the point of insertion of the needle about 1.5 cm below the orbital rim in line with the midpupillary line. This reduces the chances of bruising [Figures 6 and 7].

Cross-linked HA with lignocaine (Juvederm Ultra@XC) is injected with a 30-gauge needle. Juvederm@ Ultra XC has a cross-linking process called Hylacross™ which provides a concentration of 24 mg/mL of HA. The 6% cross-linked composition produces a soft, viscous, nonbeaded gel which helps in smooth injection and is intended to enhance durability. It also has 0.3% preservative free lidocaine which helps in alleviating pain during and after the injection. The patient is comfortable during the procedure. Patient compliance improves as well.

The needle is directed diagonally up towards the medial canthus and plunged deep into the skin through the muscle right up to the periosteum. HA is deposited subperiosteally to a visual end point of optimal correction. Protection of the globe is ensured by palpating the infraorbital rim with the noninjecting hand [Figure 8].



**Figure 6: Marking of tear trough filler (injection points and direction of needle)**



**Figure 7: Marking of tear trough filler**



**Figure 8: Subperiosteal injection of hyaluronic acid filler towards medial canthus, note the patient is comfortable even while injecting due to premixed lidocaine present in the syringe**

The needle is slowly withdrawn and the material is not injected while the needle is being withdrawn, as superficial injections are bound to give a Tyndall effect in this area. The direction of the needle is then changed vertically up towards the midpupillary line and plunged again into the periosteum. Another depot injection is given [Figure 9]. A third injection is given only if there is loss of tissue below the lateral orbital rim. The direction of the needle is changed diagonally up towards the lateral canthus to give another depot subperiosteally [Figure 10]. Usually about 0.2 mL is adequate per depot. The area is gently massaged for an even distribution of the product [Figure 11]. This also ensures that there are no lumps or irregularities. However, vigorous massage should be avoided in this area as it can push the substance onto the globe. Care is taken to inject away from any visible blood vessels in this area. Ice packs can be applied to the treated area to reduce oedema, bruising and discomfort. The patients are asked to avoid massage or any facial treatments for a week.

The patient is asked to follow up in 15 days to see if a touch-up is required. HA is injected until the point of full correction, if necessary. The patients are asked to follow up again in 6, 12, 15 and 18 months. The observation of the author has been that a HA in the tear trough area usually lasts for up to 12-15 months [Figures 12-15].

**Key points for tear trough injection**

1. Low-viscosity HA can be safely injected to correct tear trough deformity. High-viscosity HA and nonbiodegradable agents should not be injected in the tear trough area.
2. Injections must be at a supraperiosteal level of the orbital rim under defect.
3. One should be cautious around the infraorbital foramen.
4. The HA filler should be gently massaged for even distribution; strong massage should be avoided.
5. Overcorrection should be avoided. HA is hydrophilic and may cause a swelling due to its property of attracting water.<sup>[29]</sup> There is a study which shows that



Figure 9: Subperiosteal injection of hyaluronic acid filler towards midpupillary line



Figure 10: Subperiosteal injection of hyaluronic acid filler towards lateral canthus



Figure 11: Gentle massage of the filler for even distribution



Figure 12: Male: Before tear trough filler treatment



Figure 13: Male: After tear trough filler treatment



Figure 14: Female: Before tear trough filler treatment



Figure 15: Female: After tear trough filler treatment

HA can also cause stimulation of *de novo* production of collagen. Hence, it is best to undercorrect the tear trough area to prevent bulges under the eye.<sup>[30]</sup> A touch can always be done if necessary when the patient comes for a follow up.<sup>[18]</sup>

### POST-TREATMENT MANAGEMENT

1. The patients should avoid strong or extended pressure within the treated area.<sup>[18]</sup>
2. The patients should be informed about after-care such as avoiding massage, strenuous physical

activity and exposure to extreme cold or heat for up to six hours post treatment.<sup>[31]</sup>

3. It is important to schedule follow-up sessions to assess the clinical result. Touch-ups may be performed in the follow-up sessions if required.<sup>[18]</sup>

### COMPLICATIONS

#### Immediate complications

- Pain (HA fillers with lignocaine, for example, Juvederm® Ultra XC, are more comfortable for patients as the pain is alleviated)
- Erythema
- Swelling and bruising<sup>[17,31,32]</sup> (this can be minimised by applying firm pressure and ice packs before and after the treatment session)
- Asymmetry
- Migraine

#### Delayed complications

##### Orange-brown staining

Injection of the tear trough or periorbital region with any dermal filler may also be associated with bruising and subsequent deposition of hemosiderin, giving an orange-brown or rusty, stained appearance to the skin that may take months to resolve on its own. Preinjection ice application, proper depth of injection, discontinuation of anticoagulants at least seven days before injection, and a smooth, gentle technique may help avoid this complication.<sup>[33]</sup>

##### Postinflammatory hyperpigmentation

It is often seen in darker skin types due to bruising and haematoma. It may last for a very long period and can be difficult to treat.

##### Puffiness

Overcorrection with HA products in the periorbital area also may cause a puffy, oedematous appearance of the lower eyelids because of the hydrophilic nature of the filler. The oedema may seem to wax and wane, fluctuating in patients with allergic predispositions or in response to dietary intake of salt. Caution should be exercised when approaching patients with festooning (the small bag-like protrusions usually located at the inferior-lateral aspect of the lower eyelids/upper cheek) or in areas of lymphoedema when using HAs. HAs are highly hydrophilic and may exacerbate the condition.<sup>[33]</sup>

##### Infections

Though extremely rare, they can present as single or multiple erythematous and fluctuant nodules that are best treated with antibiotics active against frequent skin bacteria including *Staphylococcus epidermidis* or *Propionibacterium acnes*. Filler injections should not be performed if there is an infection in the adjacent site.



### The Tyndall effect

HA when injected too superficially can lead to a bluish discoloration under the skin. This bluish discoloration is due to the Tyndall effect where the blue light spectrum is scattered by the colloid particles more strongly.<sup>[34,35]</sup>

### Nodules

Nodules can occur with superficial infections. They can be treated with local massage, aspiration or incision and drainage of the product. Hyaluronidase can be used to dissolve a nodule or a focus of overcorrection in the case of HA-based fillers. However, a preliminary skin test is necessary to rule out an allergic reaction to hyaluronidase.<sup>[36]</sup>

### Blindness

Although extremely rare, this may be an under-reported complication.<sup>[13]</sup> According to Coleman, 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.<sup>[37]</sup> 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 minimised by moving the needle tip, and by injecting slowly, with minimal pressure and minute quantities of the filler at a time.

## CONCLUSIONS

Tear trough deformity can be corrected with an HA filler. It is less invasive and there may be minimal downtime due to swelling and bruising.

The volume injected varies from patient to patient and overcorrection should be avoided. Better results will be achieved if the patient is reassessed in two to four weeks and then additional treatment is performed to achieve complete correction. Care should be taken to avoid injection through the orbital septum (by staying -1 cm below the orbital rim), to avoid accentuating pseudoherniation.

Overcorrection, too superficial injections, and choice of an inappropriate filler may lead to unacceptable aesthetic results.<sup>[38-41]</sup>

High overcorrection or irregularity with HA fillers can be corrected by off-label use of hyaluronidase.<sup>[42,43]</sup>

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