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Periorbital Hollowness and Tear Trough

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Abstract:

Background: Periorbital hollowness and tear trough deformity represent common aesthetic concerns affecting the infraorbital region and contributing to a fatigued or aged facial appearance. The tear trough is defined as a concave depression extending from the medial canthus toward the mid-pupillary line at the lid–cheek junction. Its development is multifactorial, involving age-related changes in skin elasticity, redistribution and atrophy of orbital and midfacial fat, ligamentous tethering, muscle dynamics, and progressive skeletal remodeling of the infraorbital rim and maxilla. These anatomical and physiological alterations lead to a visible hollow that may be accompanied by hyperpigmentation, shadowing, and orbital fat prolapse, significantly influencing facial aesthetics and patient perception of aging. Because the periorbital region plays a key role in facial expression and social interaction, the presence of tear trough deformity can negatively affect self-confidence and quality of life. Understanding the anatomical basis, pathophysiology, and clinical presentation of infraorbital hollowness is therefore essential for accurate assessment and appropriate management. This mini-review highlights the current concepts regarding the anatomy, etiology, classification systems, and clinical significance of tear trough deformity, providing an overview that can guide clinicians in evaluation and treatment planning.

Keywords: Tear trough deformity; Periorbital hollowness; Infraorbital hollow; Lid–cheek junction; Periorbital aging; Facial aesthetics.

Introduction:

Definition of Tear Trough Deformity

The tear trough deformity is defined as a concave depression in the medial inferior periorbital region, appearing as a hollow or groove that starts at the inner corner of the eye (medial canthus) and extends outward and downward. Anatomically, it corresponds to the area where the lower eyelid skin meets the thicker cheek skin, typically ending at a point below the pupil (the mid-pupillary line). In other words, it is the medial segment of the lid-cheek junction. The term “tear trough” was popularized by Flowers in 1993, but earlier descriptions exist: Whitnall (1932) described a “fascial interstice” in this location, and Duke-Elder and Wybar (1961) coined the term “nasojugal fold” for the line of attachment between the loose eyelid tissue and denser cheek tissue. Today, the tear trough generally refers to the hollow under the inner half of the lower eyelid, distinguished from other grooves by its position and cause. Crucially, it lies within the orbit’s muscular boundary – specifically between the orbital and palpebral portions of the orbicularis oculi muscle. This differentiates it from the nasojugal groove (often used synonymously in casual usage) which some anatomists define as the lower border of the orbital muscle, and from the palpebromalar groove which extends laterally beyond the tear trough. (1)

In clinical terms, a tear trough deformity presents as a sunken valley starting near the inner corner of the eye, which can create a shadow or dark area that gives the impression of fatigue or aging. It may be present in youth due to genetics (e.g. those with relatively less infraorbital fat or a prominent orbital rim can have a tear trough even in their 20s), or it can develop/worsen with age. Mild forms appear as just a subtle hollow or line, whereas severe forms are deep troughs that sharply delineate the lower lid from the cheek. It’s important to note

that tear trough deformity is distinct from under-eye pigmentation or lower eyelid puffiness, though those issues often coexist. By definition, the tear trough is about volume deficiency in the medial infraorbital region. (2)

Thus, the tear trough deformity can be succinctly defined as the medially located infraorbital hollow (depression) that runs obliquely from the medial canthus to roughly below the pupil, demarcating the lid-cheek junction. It is the target of both surgical and nonsurgical cosmetic treatments aiming to restore a smooth transition from the lower eyelid to the upper cheek. (3)

Infra-Orbital Hollow and Lid–Cheek Junction

The term infra-orbital hollow (IOH) refers more broadly to the curvilinear sunken area under the eyes that can include not only the tear trough (medial hollow) but also the continuation of this concavity across the midface. It is often described as a U-shaped depression under the eye, spanning from the nose (medially) to the area under the outer canthus (laterally). The infra-orbital hollow comprises three anatomic groove segments: the tear trough and nasojugal fold medially, and the palpebromalar groove laterally. Collectively, these define the lid–cheek junction, which is the visible separation between the lower eyelid region above and the cheek region below. In a youthful face, this junction is imperceptible – the lower lid blends smoothly into the cheek with no distinct break. As changes occur (aging or otherwise), the junction becomes marked by a combination of depressions (hollows) and sometimes bulges (e.g., malar fat pads or festoons) that create a "hill and valley" appearance. (4)

It's useful to clarify terminology: historically, the nasojugal groove was often used synonymously with tear trough. However, anatomically, one can differentiate them. The tear trough is essentially the upper, inner part of the nasojugal groove – it lies between the orbital part and palpebral part of the orbicularis muscle (i.e., in a more superior position). The nasojugal groove proper corresponds to the inferior border of the orbicularis oculi muscle, i.e. the line where the orbital orbicularis ends and cheek begins. In practice, these terms overlap and many use them interchangeably. The palpebromalar groove, sometimes called the orbital–malar sulcus, is the lateral extension of this hollow running beneath the lateral canthus and over the zygomatic bone. Not everyone develops a pronounced palpebromalar groove – it often comes with more advanced aging or specific anatomy (like a high cheekbone with soft tissue descent). (5)

The lid–cheek junction is simply a descriptive term for where one sees a demarcation between eyelid and cheek. In a smooth lid–cheek continuum, there is no obvious lid-cheek junction. In a pronounced case (often graded as severe tear trough deformity), the junction is very obvious: the eyelid appears separate from the cheek, often delineated by the infraorbital hollow (above which is the "bag" or eyelid, and below which is the cheek). Surgeons and injectors assess the lid–cheek junction by looking at how far lateral the hollow extends, how deep it is, and whether it is sharp or gradual. For example, an H-shaped or V-shaped deformity on frontal view can indicate a long continuous hollow from the inner to outer eye. (6)

Etiology and Pathophysiology

The development of a tear trough deformity or infraorbital hollowness is multifactorial, involving a combination of age-related changes and individual anatomic factors. Key etiological factors include changes in skin, fat, muscle, ligament, and bone structures:

- **Skin and Soft Tissue**: With age, the skin in the lower eyelid thins out due to loss of collagen, elastin distortion, and overall volume loss in the dermis. Thin skin drapes more closely over bony and fatty contours, revealing hollows and underlying vasculature (leading to dark appearance). Also, chronic sun exposure and genetics can induce periorbital hyperpigmentation or a translucent quality that makes hollows look darker. The skin's elasticity declines, so it doesn't "shrink-wrap" the orbital rim tightly, contributing to a slight sag or redundancy that accentuates the trough. Additionally, dilation of dermal capillaries and venules can darken the area and indicate poor circulation, sometimes accompanying tear troughs. (7)
- **Orbital and Facial Fat**: Young, well-positioned fat provides a smooth contour. Over time, there is redistribution and atrophy of fat pads in the midface. The orbital fat pads may undergo pseudo-herniation

(protrusion) due to orbital septum laxity, causing an adjacent depression just below (the trough) where fat is lacking. Meanwhile, the suborbicularis oculi fat (SOOF) and other cheek fats can descend or diminish, removing support from below the orbital rim. This results in a "deflation" above the ligament (hollow) and sometimes a "inflation" below (malar bag). In some individuals, congenital underdevelopment of the malar prominence or simply less subcutaneous fat in the upper cheek predisposes them to a tear trough in early adulthood (they essentially lack the soft tissue volume to create a smooth transition). Conversely, significant orbital fat prolapse (eye bags) can deepen the relative trough by contrast – the "hill" of fat makes the neighboring "valley" look deeper. (8)

- **Muscle and Ligament**: The orbicularis oculi muscle can contribute in two ways. First, with age there is laxity of the orbicularis oculi, and often a detachment or stretching at the orbital rim, which reduces support for the overlying skin and fat, allowing a hollow to form. Second, the muscle's repeated action and any hypertrophy can fold the skin, creating a groove. In some patients, a hypertrophic pretarsal orbicularis (orbicularis roll) above the trough exaggerates the appearance by contrast. The orbitomalar ligament (tear trough ligament) and the zygomaticocutaneous ligament act as tethering points; with age, these retaining ligaments might become more pronounced or alternatively may bowstring as surrounding fat descends. A hyperlax orbitomalar ligament can manifest as a puffy area above it (malar edema) and a hollow right at its attachment. On the other hand, a very tight ligament in the context of fat atrophy will directly create a visible hollow (since the skin is anchored and cannot fall inward, the area behind it simply lacks volume and looks sunken). (9)
- **Bone Structure**: The facial skeletal framework changes subtly with age. Notably, the inferior orbital rim and maxilla can recede or remodel, effectively widening the orbital aperture and reducing support for the under-eye tissues. A loss of bony volume or an inherently posteriorly set infraorbital rim means the soft tissue has less projection and falls into a concave shape. As the malar bone (cheekbone) loses volume or as maxillary retrusion occurs, the cheek below the eye flattens, removing what was once a smooth convex scaffold under the lid. This skeletal involution is a critical but often invisible contributor – patients with marked midface bone retrusion often exhibit deep tear troughs even if their soft tissues are relatively intact. (10)

Clinical Presentation

Clinically, patients with a tear trough or infraorbital hollow present with a characteristic tired or sunken appearance around the eyes. The hallmark is a depressed groove starting near the inner corner of the lower eyelid and running outward. Patients often describe it as "dark circles under my eyes" or "hollowness under the eyes." On examination, the area may have a shadow in overhead light due to the depth of the hollow, which can give a dark discoloration even without true pigmentation issues. Frequently, there is concomitant periorbital hyperpigmentation or bluish discoloration – partly from thin skin showing underlying structures and partly from the shadow effect. The tear trough depression can be better visualized by gently stretching the skin or observing the patient's profile: one will notice a concavity under the eye. (11)

The severity can range from mild (a subtle inner corner dip) to severe (a deep, long trough extending across the entire under-eye). In more advanced cases, it's often accompanied by orbital fat prolapse (bulging "eye bags") just above the trough, which makes the hollow look deeper by contrast. There may also be a visible palpebromalar groove laterally, creating an overall "circle" or demarcation around the under-eye. The overlying skin might show fine lines, crepey texture, or wrinkling, which can worsen the appearance in dynamic expressions (e.g., smiling can bunch the skin and deepen the trough). Some patients have a notable orbicularis muscle prominence (a roll) just above the trough that becomes evident when they smile or close their eyes tightly. This dynamic bulge can accentuate the hollow directly beneath it. (1)

Patients commonly report that they look tired or older than they are, despite adequate rest. They may note that concealer makeup only partially helps, or that others ask if they are "feeling okay" due to the perceived fatigue or sadness in their eyes. The onset of the tear trough can be gradual, often noticed in the late 20s to 30s as an early sign of aging, but certain individuals (even in late teens or early 20s) may have a hereditary tear trough

that is not age-related. In those with allergies or chronic sinus conditions, intermittent swelling can alternate with hollowness, giving a fluctuating trough depth. (12)

On palpation, one might feel a slight step-off at the orbital rim where the trough is. Some practitioners do a snap test on the lower lid to check for elasticity – patients with poor skin tone might have both a tear trough and a slight lid malposition (though that pertains more to surgical considerations). It's also useful to examine the patient in different lighting and head positions: often the trough is most visible in overhead light that casts a shadow. When light is shone from below, the shadow diminishes, confirming that a lot of the "dark circle" is shadow contribution. (13)

In clinical photography, the tear trough is best captured in a 45-degree lighting to highlight the concavity. Often, standardized scales or grading systems are used during the exam (see Section 2.5) to classify the deformity. For instance, Sadick's Tear Trough Rating Scale grades the trough based on depth and extent, correlating with what the clinician sees: Grade 1 might be a shallow trough confined medially, Grade 3–4 a deep trough extending laterally with bags and skin changes. (14)

Overall, the clinical presentation is one of volume deficit under the eyes, possibly coupled with skin changes. It is usually bilateral (symmetrical to some degree), though patients often feel one side is worse. Patient complaints typically revolve around aesthetic concerns: looking tired, drawn, or older, and frustration that topical cosmetics have limited effect. Importantly, part of the clinical evaluation is distinguishing a true tear trough (anatomical hollow) from primarily pigmentation issues or edema issues. If one pulls the skin taut and the hollow persists, it indicates volume loss; if the hollow disappears but dark color remains, pigmentation is more at play. Many patients have a combination: a real hollow plus dark pigmentation. Recognizing this guides treatment (filler for volume vs. lasers/creams for pigment, etc.). (14)

Classification Systems

Various classification systems have been developed to offer an objective method for assessing the tear trough deformity and to assist the surgeon in selecting suitable treatment choices. In 2010, Hirmand introduced a classification system for the tear trough deformity grounded in clinical assessment. (9)

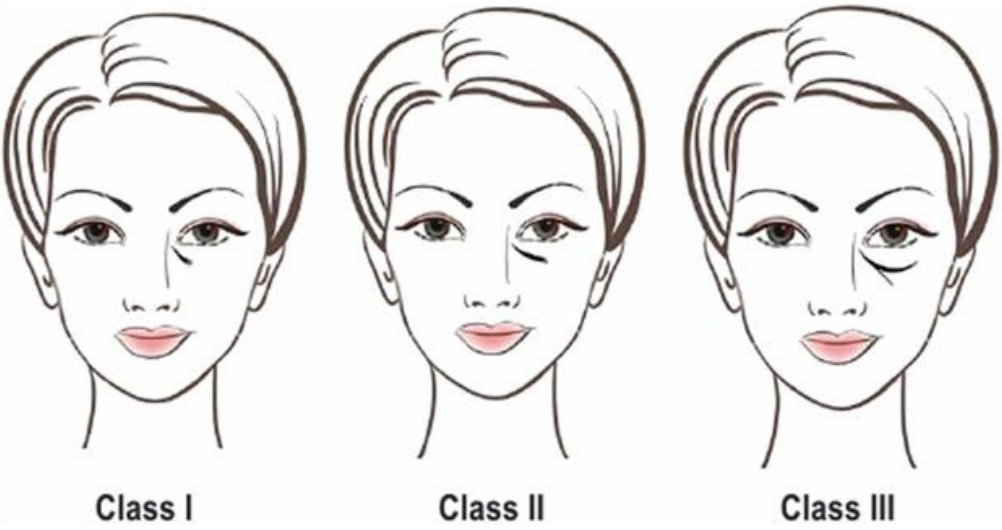

Figure 1: Hirmand classification of tear trough deformity (15)

- Class I patients have volume loss limited medially to the tear trough. These patients can also have mild flattening extending to the central cheek.
- Class II patients exhibit volume loss in the lateral orbital area in addition to the medial orbit, and they may have moderate volume deficiency in the medial cheek and flattening of the central upper cheek.

- Class III patients present with a full depression circumferentially along the orbital rim, medial to lateral. (15)

Barton et al proposed a grading system based on anatomic analysis in an effort to objectively analyze their postoperative results:

- Grade 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
- Grade I: Mild, subtle presence of a medial line or shadow; smooth lateral transition of lid-cheek junction
- Grade II: Moderate prominence of a visible demar cation of the lid-cheek junction, extending from medial to lateral
- Grade III: Severe demarcation of the orbit-cheek junction, with an obvious step between the orbit and the cheek. (16)

Lee and Hong created the Tear Trough Rating Scale using both objective and subjective assessments of the clinical characteristics of the tear trough, focusing on trough depth, hyperpigmentation, amount of herniated fat, and skin rhytidosis. (17)

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 millimeter of depth is given one point . (18)

Hyperpigmentation: dyspigmentation, while 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 hyper pigmentation. (19)

Prolapse of the nasal fat pad: notable prolapse of the nasal fat pad enhances the depth of the trough and is classified as mild (one point), moderate (two points), or severe (three points). (20)

Rhytidosis: the rhytidosis of the lower eyelid skin exacerbates fatty prolapse and the profundity of the trough; skin rhytidosis is evaluated on a scale of one to four (mild, moderate, advanced, and severe, as per Glogau's scale), with the rating reflecting the given point total. (21)

Aesthetic Impact and Patient Complaints

The aesthetic impact of periorbital hollowness is significant, given that the eyes are a central feature in facial expressions and perceptions. A pronounced tear trough or dark under-eye hollow can impart an appearance of fatigue, sadness, or aging that may not reflect how the individual actually feels. Psychologically, this can affect a person's self-confidence; many patients report that despite feeling energetic or youthful, they are frequently told by others that they look "tired," "unwell," or older than their age. This discordance often drives them to seek treatment. (22)

From an objective standpoint, under-eye hollows can alter the facial aesthetic balance. The ideal youthful face has smooth transitions, especially around the eyes (which are often described poetically as "bright" or "well-rested"). A deep hollow breaks that harmony, creating a stark contrast between the eyelid and cheek. Because the human gaze is naturally drawn to the eyes during interactions, any darkness or depression there is quickly noticed and subconsciously interpreted as a sign of exhaustion or sadness. Studies in social perception have indicated that people with more significant dark circles or tear troughs are judged as more tired or even sadder by observers. In fact, the presence of a tear trough deformity has been shown to influence facial recognition of emotion – for example, a neutral face with under-eye hollows might be interpreted as concerned or sorrowful due to the shadow pattern mimicking the appearance we have when upset or sleep-deprived. (16)

Common patient complaints include:

- "No matter how much sleep I get, I still look tired."
- "I have these dark circles that make me look unhealthy."

- "People ask me if I'm sick or upset – it's frustrating because I'm fine."
- "Makeup creases in that area and can't fully cover the darkness."
- "I feel like I look older than I am, especially in photos." (23)

Patients often try various remedies before seeking professional help: topical eye creams (caffeine, vitamin K, retinol, etc.), home remedies like cold tea bags or cucumber slices to reduce puffiness, color-correcting makeup to hide the dark hue. While these can provide mild improvements (e.g., slightly tightened skin or covered pigmentation), they do not fix the volume deficit. This leads to dissatisfaction and the realization that a more definitive treatment (like fillers or surgery) might be needed. (19)

In terms of quality of life, those particularly bothered by their under-eye appearance might avoid candid photography or use photo filters, and in some cases, it affects their work or social life confidence. The eyes are crucial in industries like media, hospitality, etc., where a "bright-eyed" appearance is equated with energy and attentiveness. Patients have reported that after correcting tear troughs they "no longer get asked if they're tired" and they feel their outside now matches their inside – for instance, a young parent who finally doesn't look perpetually exhausted despite the challenges of parenthood. (24)

From an anatomical aesthetics perspective, the tear trough is part of the midface continuum, and its treatment can have a refreshingly disproportionate positive effect on appearance. It's often noted that improving the under-eye area makes the whole face look more youthful and rested. This is why tear trough filler treatments have become very popular in cosmetic practice – the impact-to-risk ratio is favorable when done correctly, and patient satisfaction is generally high. That said, patient education is important because if there are other contributors (like hyperpigmentation or festoons), those might still need to be addressed for an optimal result. (25)

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