

Lacrimation

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October 2, 2025

RECOMMENDED CITATION

mohammad looti (2025). *Lacrimation*. PSYCHOLOGICAL SCALES. Retrieved from
<https://scales.arabpsychology.com/?p=31645>

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Primary Disciplinary Field(s): Ophthalmology, Physiology, Pathology

1. Core Definition

Lacrimation refers to the physiological process of tear secretion, but in common medical parlance, it predominantly signifies the **excessive production of tears**, often beyond the normal homeostatic needs of the ocular surface. This phenomenon, also known as epiphora when it specifically denotes the overflow of tears onto the cheek due to impaired drainage, is distinct from the basal tear production essential for maintaining ocular surface health. Basal tears, continuously produced by the accessory lacrimal glands, form the pre-corneal tear film, which is crucial for lubricating the eye, clearing debris, providing oxygen and nutrients to the cornea, and possessing antimicrobial properties. In contrast, lacrimation, or reflex tearing, is a protective response elicited by various stimuli.

The excessive secretion is a complex reflex involving neural pathways that detect irritants on the ocular surface or in surrounding tissues, subsequently triggering an amplified output from the main lacrimal gland. While serving a protective role to flush out foreign bodies or dilute irritants, persistent or unprovoked lacrimation can be a symptom of underlying ocular pathology, systemic conditions, or structural anomalies. Understanding the distinction between normal tear film dynamics and pathological hypersecretion is fundamental for accurate diagnosis and effective management of patients presenting with watery eyes. This intricate balance underscores the multifaceted nature of the lacrimal system.

A common and often counterintuitive cause of excessive tearing is **dry eye syndrome**, a condition characterized by insufficient lubrication or an unstable tear film. When the eye's surface becomes dry or irritated due to inadequate basal tear production or rapid tear evaporation, it paradoxically triggers a reflex arc that stimulates the main lacrimal gland to produce a flood of tears. These reflex tears, however, often lack the optimal composition of basal tears, being more aqueous and less rich in essential mucins and lipids, which can lead to rapid evaporation and continued ocular surface irritation, thus perpetuating the cycle of dryness and reflex tearing. This paradoxical response highlights the complex interplay between tear quantity and quality in maintaining ocular surface integrity.

2. Physiology of Tear Production

The production of tears is a highly sophisticated process orchestrated by the lacrimal functional unit, which comprises the lacrimal glands, ocular surface (cornea, conjunctiva), meibomian glands, and neural connections. The main lacrimal gland, located in the superotemporal orbit, is

responsible for the bulk of reflex tearing, responding to emotional stimuli or irritants. Additionally, accessory lacrimal glands, such as the glands of Krause and Wolfring embedded within the conjunctiva, contribute to the continuous basal tear secretion, crucial for maintaining the ocular surface between blinks. The neural innervation, primarily parasympathetic fibers originating from the facial nerve, plays a pivotal role in regulating lacrimal gland secretion, with cholinergic agonists stimulating tear production.

The **tear film** itself is a trilaminar structure, each layer contributing uniquely to ocular health. The outermost **lipid layer**, secreted by the meibomian glands, prevents evaporation of the aqueous layer and provides a smooth optical surface. The middle **aqueous layer**, produced by the main and accessory lacrimal glands, constitutes the largest volume of the tear film, providing oxygen, electrolytes, and growth factors to the cornea, and carrying antimicrobial proteins such as lysozyme, lactoferrin, and immunoglobulin A. The innermost **mucin layer**, secreted by conjunctival goblet cells, anchors the aqueous layer to the hydrophobic corneal epithelium, promoting wettability and distributing tears evenly across the ocular surface. Disturbances in any of these layers can compromise tear film stability, leading to irritation and, potentially, reflex lacrimation.

Tear production is a finely tuned process, subject to both neural and hormonal regulation. Sensory nerves in the cornea and conjunctiva detect changes in ocular surface conditions, transmitting signals to the brainstem, which then activates parasympathetic pathways to stimulate lacrimal gland secretion. This reflex arc ensures that the eye can respond rapidly to adverse environmental stimuli or injury. Furthermore, sex hormones, particularly androgens, have been implicated in modulating lacrimal gland function and tear film composition, explaining some gender-related differences in the prevalence of dry eye syndrome. The intricate balance of tear production, distribution, and drainage is paramount for clear vision and comfort, making any disruption a potential cause for concern.

3. Etiology and Common Causes

The causes of **lacrimation** are diverse, ranging from benign environmental irritants to serious underlying ocular or systemic pathologies. As highlighted, **dry eye syndrome** (DES), or keratoconjunctivitis sicca, is a paradoxical yet frequent cause. In DES, the inadequate quantity or quality of basal tears leads to chronic ocular surface irritation, which then triggers a reflex arc, signaling the main lacrimal gland to overproduce tears. These reflex tears, however, are often hyperosmolar and contain fewer essential components, leading to rapid evaporation and continued irritation, thus perpetuating a vicious cycle of dryness and reflex tearing, commonly known as "watery dry eye."

Other significant causes of lacrimation involve direct irritation or inflammation of the ocular surface or adnexa. These include various forms of **conjunctivitis** (allergic, bacterial, viral), **keratitis**

(corneal inflammation), and the presence of **foreign bodies** on the cornea or under the eyelids. Conditions causing mechanical irritation, such as trichiasis (in-grown eyelashes), entropion (inward turning eyelid), or ectropion (outward turning eyelid), can also lead to chronic tearing due to improper lid-globe apposition and inadequate tear drainage or constant irritation. Chemical irritants, exposure to strong winds, smoke, or pollutants are common environmental triggers for transient but often intense lacrimation.

Furthermore, certain systemic conditions and neurological disorders can manifest with lacrimation. Bell's Palsy, affecting the facial nerve, can impair both tear production (leading to dry eye) and eyelid closure (exacerbating exposure and reflex tearing). Crocodile tears syndrome, or Bogorad's syndrome, is a rare condition where gustatory stimuli inappropriately trigger lacrimation due to aberrant regeneration of facial nerve fibers. Pharmacological agents, particularly certain ophthalmic drops or systemic medications with cholinergic side effects, can also induce excessive tearing. Obstruction of the lacrimal drainage system, while not strictly a cause of *overproduction*, results in tear overflow (epiphora) and is often clinically indistinguishable from true lacrimation without further investigation.

4. Clinical Manifestations and Associated Conditions

Patients presenting with lacrimation typically report an uncontrollable watering of the eyes, which can range from a mild annoyance to a significant impairment of daily activities, affecting vision and comfort. Beyond the obvious symptom of tear overflow onto the cheeks, individuals may experience a constellation of other ocular symptoms including a persistent **foreign body sensation**, grittiness, stinging, burning, and itching, particularly if the underlying cause is dry eye or allergic conjunctivitis. Vision can become intermittently blurred due to the uneven tear film or the constant presence of excess tears. Photophobia (light sensitivity) is also a common complaint, especially in conditions affecting the cornea, such as corneal abrasions or keratitis, which reflexively induce tearing.

The presence of associated signs upon examination can help narrow down the differential diagnosis. For instance, redness and swelling of the conjunctiva (conjunctival hyperemia) are hallmarks of inflammation, whether infectious or allergic. Eyelid abnormalities, such as meibomian gland dysfunction, can lead to blepharitis, which often coexists with dry eye and contributes to ocular surface irritation and reflex tearing. A careful examination for eyelid malpositions, such as entropion or ectropion, is crucial, as these mechanical issues directly impair tear film distribution and drainage. Dacryocystitis, an infection of the lacrimal sac, can present with localized pain, swelling, and purulent discharge, alongside epiphora, indicating a drainage system compromise rather than hypersecretion alone.

Chronic lacrimation, if left unaddressed, can lead to several complications. The constant wetness

of the periocular skin can cause maceration, irritation, and secondary skin infections. Persistent blurring of vision can impact quality of life, affect driving, reading, and occupational performance. In cases where lacrimation is a symptom of underlying ocular surface disease, such as severe dry eye or chronic inflammation, there is a risk of progressive corneal damage, including erosions, ulceration, and neovascularization, which can ultimately impair vision permanently. Therefore, a thorough clinical evaluation is essential to identify the root cause of lacrimation and prevent potential long-term sequelae.

5. Diagnostic Approaches

Diagnosing the underlying cause of lacrimation requires a systematic approach, beginning with a detailed patient history. This includes inquiring about the duration, frequency, and triggers of tearing, associated symptoms (e.g., pain, itching, discharge, vision changes), environmental exposures, medication use, and relevant medical history. Understanding if the tearing is unilateral or bilateral, constant or intermittent, and if it worsens under specific conditions (e.g., wind, reading, morning/evening) provides crucial diagnostic clues. For instance, tearing that is worse in windy conditions might suggest dry eye, while purulent discharge points towards infection.

A comprehensive **ophthalmological examination** is indispensable. This typically involves a slit lamp biomicroscopy to assess the eyelids, conjunctiva, cornea, and tear film. Key diagnostic tests include:

Fluorescein staining: Used to evaluate the integrity of the corneal and conjunctival epithelium, revealing abrasions, erosions, or dry spots. It also helps assess tear film break-up time (TBUT), a measure of tear film stability.

Lissamine green or Rose Bengal staining: These dyes highlight devitalized or damaged cells on the conjunctiva and cornea, particularly useful in diagnosing dry eye.

Schirmer's test: Measures the rate of aqueous tear production using standardized filter paper strips placed in the lower eyelid. This test helps differentiate between aqueous-deficient dry eye and other causes of lacrimation.

Tear film osmolarity testing: An elevated tear osmolarity is a key indicator of dry eye disease.

Examination of the lacrimal drainage system: This involves evaluation of the puncta (tear drainage openings) for stenosis or malposition. A **fluorescein dye disappearance test** (FDDT) can assess the patency of the drainage system, while irrigation and probing of the lacrimal ducts may be performed if an obstruction is suspected.

Meibography: Imaging of the meibomian glands to detect atrophy or dysfunction, a common cause of evaporative dry eye.

These diagnostic tools, used in combination, allow clinicians to accurately pinpoint the etiology of lacrimation, distinguishing between overproduction and impaired drainage, and guiding appropriate

therapeutic interventions.

6. Therapeutic Interventions

The treatment for **lacrimation** is highly dependent on its underlying cause, as identified through the diagnostic process. For patients whose excessive tearing is paradoxically caused by **dry eye syndrome**, the primary goal is to restore tear film stability and ocular surface health. This often begins with conservative measures such as frequent application of **artificial tears eyedrops**, which lubricate the eye and temporarily supplement the natural tear film. Various types of artificial tears exist, with different viscosities and compositions, including those with lipids or hyaluronic acid, tailored to address specific tear film deficiencies. Additionally, environmental modifications, such as using humidifiers and avoiding direct air conditioning or fan exposure, can reduce tear evaporation.

Beyond basic lubrication, dry eye treatment may involve anti-inflammatory strategies. Topical corticosteroids can be used for short-term control of severe inflammation, while longer-term options include prescription medications like **cyclosporine** (e.g., Restasis, Cequa) or **lifitegrast** (e.g., Xiidra) ophthalmic emulsions, which modulate the immune response and promote natural tear production. **Punctal plugs**, small devices inserted into the tear drainage ducts, can be used to block tear outflow, thereby conserving the natural and artificial tears on the ocular surface for a longer duration. For meibomian gland dysfunction, warm compresses, lid hygiene, and oral antibiotics (e.g., tetracyclines) may be prescribed.

When lacrimation is due to other specific causes, the treatments diverge. If an ocular infection, such as bacterial conjunctivitis, is identified, **antibiotics** (topical or systemic) are prescribed to eradicate the causative pathogen. Allergic conjunctivitis is managed with antihistamine eyedrops, mast cell stabilizers, or topical corticosteroids. Mechanical irritants, such as in-grown eyelashes (trichiasis) or foreign bodies, require removal or epilation. For **mal-positioned eyelids** (e.g., entropion, ectropion) or significant obstruction of the lacrimal drainage system, **surgical intervention** may be necessary. Procedures can range from minor surgical correction of eyelid malpositions to dacryocystorhinostomy (DCR) to create a new drainage pathway between the lacrimal sac and nasal cavity for cases of lacrimal duct obstruction.

7. Differential Diagnosis

When evaluating a patient with lacrimation, it is critical to consider a broad differential diagnosis to ensure accurate identification of the underlying pathology. While excessive tear production is the hallmark, conditions affecting tear drainage can present with similar symptoms of watery eyes (epiphora). Key differentiators include the presence of ocular irritation, inflammation, or specific anatomical abnormalities.

Conditions to differentiate include:

Epiphora due to nasolacrimal duct obstruction: This is a common cause of watery eyes, especially in infants (congenital NLD obstruction) and older adults. Tears are produced normally but cannot drain effectively, leading to overflow. There is usually no ocular irritation unless secondary dacryocystitis (infection of the lacrimal sac) develops.

Conjunctivitis (Allergic, Bacterial, Viral): All forms can cause tearing. Allergic conjunctivitis often involves itching and bilateral redness. Bacterial conjunctivitis typically presents with purulent discharge and redness. Viral conjunctivitis (e.g., adenoviral) is often associated with watery discharge, follicular conjunctivitis, and may be unilateral initially.

Corneal Abrasions or Foreign Bodies: These cause acute, often painful lacrimation, typically unilateral, as a reflex protective mechanism to flush out the irritant.

Eyelid Malpositions:

Entropion: Inward turning of the eyelid margin, causing eyelashes to rub against the cornea (trichiasis), leading to constant irritation and reflex tearing.

Ectropion: Outward turning of the eyelid, which can cause poor tear drainage as the punctum is no longer in contact with the globe, leading to epiphora.

Blepharitis and Meibomian Gland Dysfunction: Chronic inflammation of the eyelid margins and dysfunction of the meibomian glands contribute to evaporative dry eye, which paradoxically triggers reflex tearing.

Neurological Conditions: Conditions affecting the facial nerve (e.g., Bell's Palsy, Crocodile Tears Syndrome) can impair tear dynamics or cause inappropriate lacrimal responses.

Intraocular Inflammation (Uveitis, Iritis): Though less common, inflammation within the eye can cause reflex tearing due to associated photophobia and ciliary spasm.

A careful physical examination, coupled with appropriate diagnostic tests, is essential to distinguish between these varied etiologies and guide targeted therapy for the patient's specific form of lacrimation.

8. Further Reading

[Lacrimation - Wikipedia](#)

[Dry Eye Syndrome - Wikipedia](#)

[Tear Film - Wikipedia](#)

[Lacrimal Gland - Wikipedia](#)